The Dunlop Organisation

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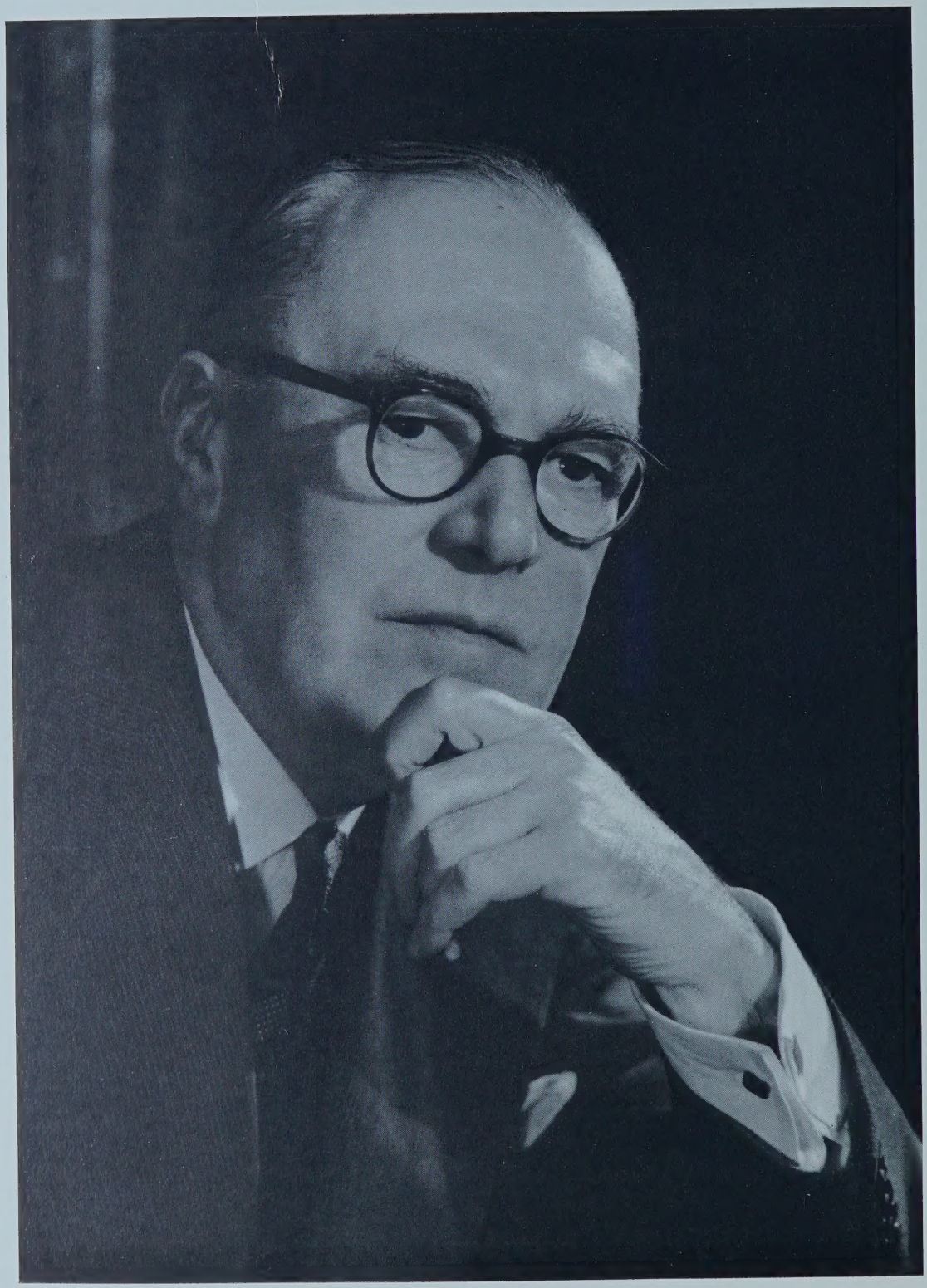


Chairman's Foreword

In the pages that follow we have attempted to describe a large and complex international business, although in a booklet of this size much has had to be omitted. It is not my intention to dwell on any of the facts and figures which are set out here, but it is worth recalling that today Dunlop spans the globe and the Company's symbol can be seen in nearly every country in the world. Behind that symbol stand over 100 factories and even more important over 100,000 people of many different races and creeds.

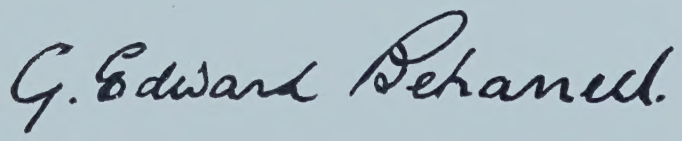
The question is often asked of me how such a large international organization can avoid becoming a vast impersonal machine, seeking only efficiency with a ruthless disregard for the individual.

It is true that we do strive for efficiency; and for profits. If we did not, we should be failing in our duty to shareholders, employees and customers alike, for the modern world makes few allowances for those that do not succeed in this.

Yet Dunlop has never forgotten that it began life by offering something revolutionary and beneficial to mankind and since then we can claim that our efforts have been devoted to developing products whose use and value is not merely measured by profitability. All the things we have invented or developed have not had the dramatic impact of the pneumatic tyre, but they have contributed in their various ways to a better living for us all.

It is this continuing concern with service and quality, emphasized by the amount of resources devoted to research and the development of new materials and products which distinguishes the Company's efforts. And this tradition ensures that the thousands of people who make up the organization can never become 'the labour force'—they are individuals with a common purpose and concern.

The importance of the individual in Dunlop has largely been responsible for the harmonious industrial relations which we have enjoyed over the years. Of course, like every other company, we have had our troubles but from the beginning we have built up the means whereby every person can have a say in matters affecting his or her welfare and working conditions. And no organization has been more loyally served by the vast majority of the employees. Such loyalty has been rewarded in the past; it will continue to be rewarded in the future as the Group keeps on growing.



Johnny Dunlop on the tricycle to which his father, J. B. Dunlop, fitted pneumatic tyres in 1889.

History

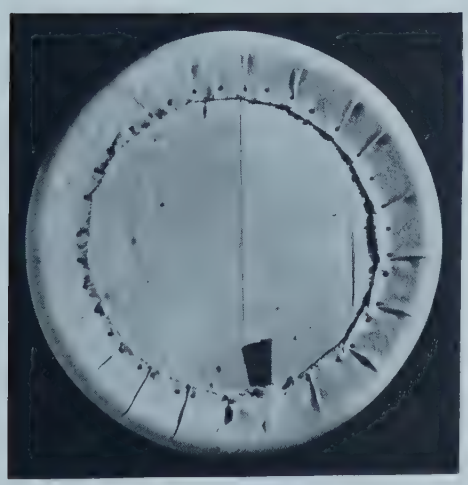
Early days

The story of Dunlop began nearly eighty years ago with a single product, now as commonplace as the wheel itself, but in those days revolutionary. This was the invention in 1888 by John Boyd Dunlop, a Scottish veterinary surgeon practising in Ireland, of the first practicable pneumatic tyre. The wheel, rigid since the days of pre-history when it had been first cut from a log, could now be cushioned.

It was in 1889 that the original company, *The Pneumatic Tyre and Booth Cycle Agency*, was formed in Ireland to develop the invention. The tyres were made from material bought from existing rubber companies, but within a few years the company had

The cake-mixer used in the invention of latex foam at the Dunlop laboratories in 1928.

acquired one of its own, *Byrne Brothers of Birmingham.*
Dunlop's invention captured the imagination of the world. Such was the demand for his tyres that, by the turn of the century, the Company had established manufacturing or selling companies in Australia, Canada, France, Germany and South Africa. In Britain, a second factory in the Birmingham area, already the heart of the bicycle industry and centre of the infant motor car industry, was added in 1900, and the Company started on the manufacture of car tyres. In the same year, the organization's present name of *Dunlop Rubber Company Limited* was adopted.
Looking back from the vast complex of activities that form the Dunlop Organization now, its story can be seen to fall into four distinct phases. The first phase, whose early steps have just been described, spans the years 1889 to 1920. This was a period of rapid diversification at home and of expansion overseas from which has grown the strong, international structure of the organization today.
Once the Company's place in the development of the motor car industry had been established, its management was quick to realize that wheels and tyres should be thought of as a single unit. So in 1906 the Company acquired a wheel manufacturing firm in Coventry and renamed it *The Dunlop Rim and Wheel Company Limited.*
Attention was next directed to getting better control over its main raw materials, rubber and textiles, and this led to a period of vertical expansion. To secure the supply of rubber, the predominant raw material of tyres, Dunlop began investing in Malayan estates in 1909, and by the 1920s was the largest single owner of plantations in that country. (It is interesting to note that today hardly any of this rubber is used in Dunlop tyres, but it is vitally important in the manufacture of other Company products.)



J. B. Dunlop's first experimental tyre. The air-filled tube was covered with canvas tacked down to a wooden disc.

Further integration took place with the establishment of cotton mills to protect the supply of tyre cord and other fabrics. The first of these Dunlop mills was opened in Rochdale in 1916, but in this case integration did not extend to the production of raw cotton which continued to be bought on the open market. Today, *Dunlop Textiles Ltd* still has its chief factory at Rochdale where processing now covers the rayon and nylon which have almost wholly replaced cotton in tyres. The factory also produces many of the materials used by *Dunlop Footwear Ltd* and by the *Belting, Hose and General Rubber Goods Divisions.*
Growth continued apace in other fields and places. New factories were opened in Japan (1909) and in the U.S.A. (1920), and new products were brought on to the market. For example, in 1908 Dunlop began the manufacture of golf balls, and two years later it was building aircraft tyres. Then in 1916 a 300-acre site was acquired on the outskirts of Birmingham and the factory, now famous as Fort Dunlop, began to take shape.
So by the end of the first world war, the Dunlop Organization had become a world-wide business and some of its products were already household names. The future seemed set fair.

Broadening the base: 1921–31

As events turned out, the progress of the Company between the two wars was equally remarkable, but not exactly as anticipated. Like many other firms, Dunlop suffered severely from the drastic collapse of world trade in 1921 ; the fall in its raw material prices was in fact quite catastrophic. However, a new top management took over the tasks of reconstructing the Company and restoring morale.

Acting on the military maxim that the best form of defence is attack, the new Board took energetic counter-measures. It decided to broaden the base of Company activities, and one of the first steps was the acquisition in 1925 of the well-known *Charles Macintosh* Group of Companies. This Manchester firm had been one of the pioneers of the British rubber industry, and at the time of the take-over was making—in addition to tyres—footwear, cables, clothing, and a general range of rubber manufactures, including hose and belting. Shortly after this, the Company disposed of the cables, more recently the clothing interests, as it was decided that these were not fields in which Dunlop should permanently engage. In 1932 the activities inherited from Macintosh became the nucleus of the Company's Industrial and Consumer Groups.

Also in 1925 Dunlop bought the business of *W. and A. Bates Ltd* of Leicester, makers of cycle tyres and rubber thread, and that of *W. Goodyear and Sons Ltd* of Dudley who manufactured wheels. This was followed by the acquisition of a racket factory at Waltham Abbey in Essex and by the formation of the *Dunlop Sports Company Ltd.*

Then in 1929 there emerged from the Dunlop laboratories an invention which ranks second in importance only to the pneumatic tyre. This was 'Dunlopillo' latex foam which was to revolutionize standards of comfort and hygiene in homes, hospitals, public buildings and transport. 'Dunlopillo' was also to create a demand for a world-wide rubber foam industry and thus provide a second main support to the rubber producing countries of South East Asia. Another product for the domestic market made its appearance in 1937 when *Dunlop Semtex Ltd* was formed to produce a range of new flooring materials.

Second overseas expansion and the war

The third phase of the Dunlop story spans the years from 1932 until the end of the second world war in 1945. After the slump of 1931, the mid-1930s saw a further considerable growth in the Company's overseas activities with the establishment of new factories in Ireland, South Africa and India and the extension of production facilities in Germany and France. At home, meanwhile, tyre production spread to Scotland with the acquisition of the *India Tyre and Rubber Company* (now *India Tyres*). Although formed only a few years previously in the late twenties, the firm had quickly gained a reputation for quality which it has maintained ever since.

As the second world war drew nearer, business continued to prosper with the growth of the motor industry and the introduction of new products. About this time there took place an important diversification in the activities of the *Dunlop Aviation*

Division. Production had already grown from tyres to wheels to brakes, and now the Division began making hydraulic and pneumatic operating systems and gun-firing mechanisms as well. The Company had in fact become precision engineers working in exotic metals and alloys.

From 1939 to 1945 all the Company's resources and technical inventiveness were devoted to the war effort. In addition to tyres, wheels and barrage balloons, a whole range of new products had to be developed and made on a large scale. Anti-G clothing for pilots, new wheel and tyre designs for the R.A.F., underwater swimming suits, and many other inventions came off the Dunlop production lines.

Though this, too, was a time of rapid growth, it was not to the Company's commercial advantage. Its rubber plantations fell into Japanese hands, its factories in France and Germany were largely destroyed, work on the development of synthetic rubbers had to be suspended, enabling the Company's American competitors to take full advantage of the delay, and a host of other projects had to be shelved. As a result, Dunlop emerged from the war with its work well done, but in a commercially weaker position than its main competitors.

Dummy tanks, made at Dunlop factories, were used to confuse enemy reconnaissance in the desert campaigns and before D-day.

Expansion and science: 1946–65

Despite these problems, the Company quickly tackled the task of gearing energies and resources to peacetime competition. New factories have been established in the United Kingdom at Speke, Castle Bromwich, Brynmawr, Hirwaun, Gateshead, Liverpool, Hindley Green and Skelmersdale. Overseas, new plant has been added in Canada, India, Japan, South Africa, France and the United States, while manufacturing activities have been opened up in New Zealand (1946), Brazil (1953), Malaysia (1956) and, Rhodesia (1959). Further overseas development has taken place in the 1960s with tyre factories started in Malaysia and Nigeria in 1962 and with the production of cycle tyres in Uganda in 1964.

Once again, rapid growth has resulted in diversification of production, so that today tyres account for less than two-thirds of the entire Company business. In 1953 the Company acquired

The new Research Centre at Sheridan Park, Toronto, opened in September 1965.

the remoulding business of *Tyresoles Ltd*, and in 1958 it added the business of the *John Bull Group*, manufacturers of rubber-bonded-to-metal components, couplings, bearings and anti-vibration mountings, as well as tyres. On the sports side, Dunlop interests have been greatly enlarged by the acquisition of *John Letters*, the golf club manufacturers, of the famous *Slazenger Group*, and of *Edgar Sealey and Sons* who make fishing rods and hooks.

In the same period a number of the Company's existing product groups, such as footwear, belting, hose and Semtex flooring have developed sufficiently to become trading units in their own right. Further divisions have been added to develop and license the disc brake and to produce *Hydrolastic* suspensions which are now such an important feature of B.M.C. cars.

opposite page:
An electron microscope at the Central Research Centre, Birmingham.

The tyre factory at Amiens, one of the four Dunlop manufacturing plants in France.

Technological achievements

The Company, however, does not measure progress only by the level and variety of its manufacturing operations. Of equal importance is the development of new products and processes and the improvement of existing lines. All companies in the Group contribute to this, but the main pioneering burden falls on the Dunlop Research Centre. The Centre has branches in Canada, Malaysia, Japan, Germany and Ireland, a dispersal of resources which underlines its policy of collaboration on a world-wide basis and which distinguishes its research effort from the more concentrated structures of its main competitors. Dunlop scientists and engineers have produced a range of new inventions, covering processes, materials, products and machinery which the Company has since exploited on a commercial basis. During the war synthetic rubber had to be imported from the U.S.A., but in 1953 Dunlop began work on the first British pilot plant for its manufacture under the guidance of the Research Centre. The experience so gained was to prove invaluable during the construction of the *International Synthetic Rubber Company* plant at Fawley (near Southampton) which was opened in 1958. I.S.R., as the company is known and of which Dunlop is the major shareholder, has today an overall production capacity for general purpose synthetic rubbers and latices of 155,000 tons a year. This figure represents the greater part of Britain's needs;

that apart, the plant exports in quantity to Dunlop factories in other parts of the world.

Meanwhile, Company interests in natural rubber are being well looked after. A vigorous and extensive replanting programme in Malaysia has been completed, and since 1963 additional supplies have been coming from the new Dunlop plantations in Nigeria.

In the twenty years since the war, the Company despite the great strides it has made, has nevertheless maintained the balance between vertical growth and horizontal expansion, and the figure of 90,000 for the number of shareholders in the Company reflects public confidence in this achievement.

With a total employed capital of well over £200 million and total sales now in excess of £300 million, plus the diverse skills and experience of 100,000 employees in every part of the globe, the Group can look forward with confidence, though not of course with complacency. The pneumatic tyre has come a long way in eighty years.

The position of the Group in 1965 can be summarized briefly in a few key figures:

EMPLOYEES	104,000	52,000 in the U.K. 52,000 in other countries
FACTORIES	111	50 in the U.K. 61 in other countries
SALES TO CUSTOMERS	£316 million	£145 million in the U.K. (including exports) £171 million overseas
EXPORTS FROM U.K.	£22 million	plus £11 million exported as vehicle components
TOTAL CAPITAL EMPLOYED	£238 million	in more than 30 different countries
PROFIT (BEFORE TAX)	£18·9 million	equal to 1/2*d.* for every £1 of sales
TAXATION	£9·1 million	equal to 7*d.* for every £1 of sales
DIVIDENDS PAID TO SHAREHOLDERS	£4·8 million	equal to 3½*d.* for every £1 of sales
NUMBER OF ORDINARY SHAREHOLDERS	68,000	plus 22,000 preference shareholders

OWNERSHIP OF ORDINARY SHARES:

Amount of Holding	Number of Ordinary Shareholders
1 — 250 shares	20,700
251 — 500 shares	20,200
501 — 1,000 shares	16,000
1,001 — 2,500 shares	8,400
2,501 — 5,000 shares	1,600
Over — 5,000 shares	1,100

Organization and Control

Before the second world war Dunlop had been a centralized organization in which progress and expansion depended largely on the calibre and initiative of the top management. It was a policy well suited to the needs and structure of the business at that time, and it worked with purpose and profit.

However, it soon became clear after the war that, if the Company was to retain its drive and vitality, a number of changes would have to be made in the organization structure and in the pattern of management control. For one thing, the Group was expanding rapidly and its operations were becoming increasingly far-flung and complex. The Company was also faced with the need to improve its return on capital and to give promising young men the chance of proving their worth.

In order to meet these requirements, the organization has been decentralized as far as possible, so that today each decision is taken at the level where available knowledge and experience are most likely to provide the best answer. More authority has been delegated to the managers in the field, including responsibility for profit and loss. These steps accord with the best in modern management practice, and have proved signally successful in Dunlop.

Overall control of Company affairs is vested in the Main Board. Under the Chairman, this consists of eight executive directors, headed by the Managing Director, and six non-executive directors. The executive directors are men who have risen through their own ability from the ranks in various parts of the Group, while the non-executive directors are men of high reputation and wide experience in commerce and industry.

Sir G. EDWARD BEHARRELL
Chairman

***REAY GEDDES, O.B.E.,**
Managing Director

The Rt. Hon. Lord BAILLIEU, K.B.E., C.M.G.
President

***L. J. W. BAILEY** ***D. B. COLLETT**

Sir ARCHIBALD F. FORBES, G.B.E.

***D. W. HAWKINS** ***ERIC HOLT** **JOHN H. LORD**

***E. W. MADGE**

The Rt. Hon. REGINALD MAUDLING, M.P. ***T. E. PEPPERCORN**

The Rt. Hon. Lord ROBERTSON, G.C.B., G.B.E., K.C.M.G., K.C.V.O., D.S.O., M.C.

***J. WRIGHT, C.B.E.**

(*Executive)

The Main Board meets once a month to review all matters of policy and in particular those concerned with finance, capital expenditure, and new projects. The Board also keeps a close and regular watch on the current trading figures of all companies and divisions of the Group. For the executive directors, however, the most important responsibility is the task of probing and planning for the future, continuous activities carried out in consultation with senior management.

Senior managers in the Dunlop Group fall into two broad categories. On the one hand are the general managers of the subsidiary companies and manufacturing divisions in the United Kingdom and the managing directors of Dunlop companies in other parts of the world. Each of these is responsible for the activities and results of his company or division and in turn answers to one of the Main Board's executive directors.

The second category of senior managers comprises the executives in charge of specialist divisions or departments, such as research, engineering, marketing, finance, personnel, and purchasing. Their function is to advise general managers and company managing directors on particular problems and to co-ordinate the work of similar departments at divisional or company level. This structure enables the Main Board to delegate responsibility without abdicating its authority.

An executive director is in charge of each of the five main activity groups and, through him, the chain of command reaches the Managing Director. For the system to be successful, however, the executive directors must have a sound understanding of the various divisions and companies in their charge, and this must be accomplished without unnecessary interference in day to day operations.

Management Plans

Every year each division and company prepares a Management Plan, containing a detailed appraisal of its proposed lines of action for the three years ahead. A typical Plan assesses the likely effect of general economic conditions on the industries and markets in which the division is interested. Also reviewed are problems which could well occur in marketing, engineering, production, purchasing and staffing and the ways in which these problems will be overcome. Finally, the proposals are converted into figures, and their financial implications (revenue and capital) set out in detail to provide a common basis for assessment and subsequent comparison.

Once a Plan has been discussed and agreed by the Main Board, the divisional or company management has the task of implementing it, but this does not mean putting the operational unit in a policy straitjacket. On the contrary, each general manager enjoys a wide measure of freedom in the way he sets about trying to hit the targets set. The purpose of the Plans is in fact to ensure orderly action and to avoid 'crisis management'. The plans also enable the Main Board directors to offer guidance and advice when any radical deviation from the agreed goals is manifest.

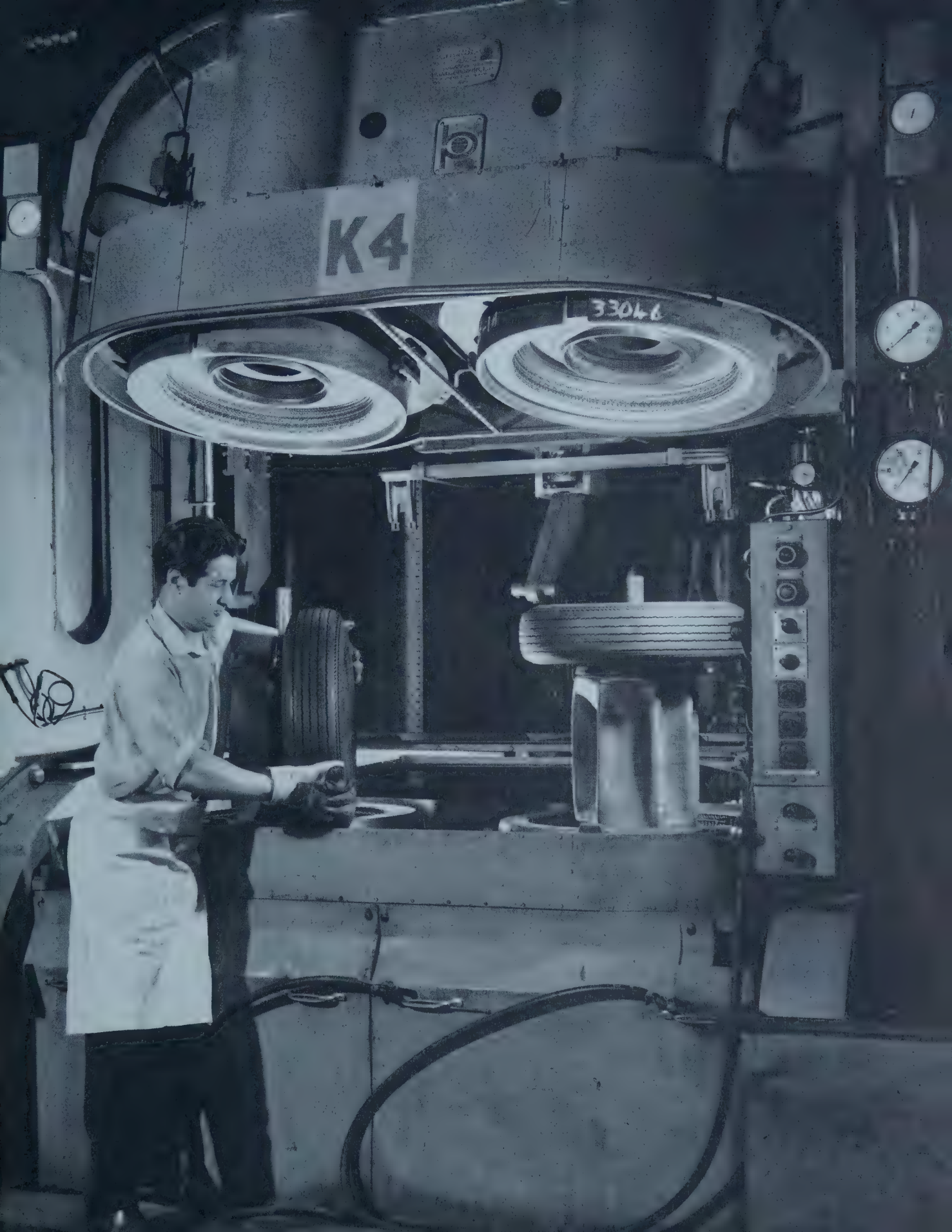
Each operating unit is expected to make a good profit and to stand on its own feet financially. General managers are also

expected to take responsibility for long-term planning and the development of new products, which in turn helps the Main Board to make more accurate assessments of the Group's long-term capital needs.

Only the members of the Main Board, however, can co-ordinate the whole Company picture and judge the effects of individual proposals on the general canvas. They alone are in a position to decide which proposals to accept and which to reject, or whether proposals emanating from outside normal divisional activities should be given preference. Conversely, when the consolidated Plans point to a need to make fuller use of resources, the responsibility for action falls on the directors. In a virile progressive business, however, with sound lines of communication, this situation will rarely, if ever, arise.

The Executive directors are of course kept fully informed about major matters in every branch of the Company. In particular, matters such as senior appointments, major capital expenditures and price policies are referred to them, and the most important to the Board as a whole.

The millionth SP.41 tyre emerging from its mould at Fort Dunlop, Birmingham, seven months after this new radial-ply tyre was introduced in October 1964.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World Organisation
Manufacturing Companies
Selling Companies
Distributors
Principal Factories
(Excluding United Kingdom)
Plantations
TORONTO
WHITBY
BUFFALO
UTICA
WESTMINSTER
HANAU
CORK
AMIENS
MANTES
LE BOURGET
MONTLUCON
CAMPINAS
IKE


NAGOYA
KOBE
IPSWICH
SYDNEY
WAGGA
NOWRA
BENDIGO
ADELAIDE
BAIRNSDALE
MELBOURNE
AUCKLAND
UPPER HUTT
WELLINGTON
WOOLSTON
PETALING JAYA
SEREMBAN
SAHAGANJ
E. FREEMANTLE
AMBATTUR
JINJA
BULAWAYO
BENONI
DURBAN
PORT ELIZABETH
REITZ

The discovery and study of aquaplaning at Fort Dunlop has been an outstanding contribution to road safety. On test, in the hands of an expert Dunlop driver, the Jaguar is travelling at 60 m.p.h. on the wet test track. Because the front tyres are almost bald they are riding or aquaplaning on a wedge of water and are not revolving, having lost contact with the road. For all intents and purposes, this car is completely out of control.

Manufacturing and Marketing – United Kingdom

Tyres Mention has already been made of the huge variety of products now made by the Company, but in the public mind the name 'Dunlop' is still first and foremost synonymous with tyres. In fact Dunlop makes every kind of tyre for which there is a demand and there are now some 1,800 different types in the range, embracing the original beaded-edge pneumatic tyres (still made for the benefit of veteran car enthusiasts) to the very latest types of radial-ply tyres. It includes tyres weighing more than a ton for earthmoving machinery, cycle tyres weighing only four ounces, and special tyres for cars attempting and achieving the world land speed record.

Dunlop's research staff have led the way in developing new

Simulating aquaplaning in the test house. The drum is revolving at 80 m.p.h. while the badly worn car tyre is stationary under load and can even be turned back and forward by hand.

synthetic rubbers with a higher coefficent of friction which, together with new tread patterns, yield tyres with much better gripping qualities, especially on wet roads. Dunlop introduced these new materials in June 1960 in a premium tyre ; today, they are being used in standard tyres in the standard price range.

Tyre development, as one would expect, is concentrated at the main tyre factory of the Group, Fort Dunlop, in Birmingham, and it is here that major advances are initiated, although every Dunlop tyre factory throughout the world is encouraged to carry on its own development work. Improvements in design and production are of course shared by all factories in the Group, including those of *India Tyres Ltd.* This company, whose headquarters are at Inchinnan (near Renfrew) in Scotland, operates as a separate entity, but it benefits from Dunlop's centralized buying and research activities.

A key operation in all tyre development is product testing, and this is carried out in several ways. For example, there is machine testing in a special test house equipped with a variety of machines and instruments, many of them designed by the Company's own engineers. Here, tyres are put through endurance tests which very quickly reveal any flaws. As a result, routine testing can be carried out in a relatively short time and under very close scientific control. It was in a test house at Fort Dunlop that Company engineers first discovered and measured the 'aquaplaning' phenomenon in car tyres. This is what happens to badly worn tyres when run at speeds of 60 m.p.h. or more on a smooth, wet road surface. A wedge of water can build up in front of and under the tyre, separating it from the road so that it aquaplanes. Such research into road holding in wet weather is leading the Company to dramatic advances in tread pattern design.

Even so, controlled road tests remain the final criterion for any pneumatic tyre, and close to Fort Dunlop is a special 'tyre proving ground' equipped with practically every type of road surface likely to be met with in motoring. Driving tests here furnish a wealth of information on both the quality of tyres and the part they play in the control of vehicles.

In addition, each major unit runs test fleets of many different types of vehicle which operate in actual motoring conditions. The United Kingdom test fleet, for example, also operates in France, Belgium, Switzerland, Scandinavia and as far afield as North Africa, in order to test tyres designed for a variety of roads and climates.

Even road tests are not regarded as enough. In its search for the highest possible quality, the Company uses a special Chassis Testing Laboratory where studies of vehicle behaviour are conducted with the aid of electronic instruments. The Company gets additional information from tests at the Motor Industries Research Association Proving Ground and from experiences in motor racing.

In this last, Dunlop is supreme. Between 1959 and 1964, first, second and third places in every World Championship Grand Prix have been taken by cars fitted with Dunlop tyres. Information gained in such exacting conditions supplies the Company

with knowledge used to improve the design of tyres for the everyday motorist.
Dunlop is aware, however, that the customer is the final judge. For his benefit, the Company runs an extensive tyre service organization to help him obtain maximum performance and to pass his views back to the tyre designer.
With its retreading service, Dunlop's interest extends to every type of customer for tyres. The Company has its own retreading factory at Speke, while its subsidiary, the *Regent Tyre and Rubber Co. Ltd,* has been working in this field since 1938.
Since the war the retreading side of the Dunlop business has been expanded not only by the building of new Regent factories but also through the acquisition of *Tyres (Scotland) Ltd* and the Tyresoles organization with its wide overseas connections. Another subsidiary, *Tyre Equipment and Reconditioning Company Ltd* (*Terco Ltd*), has been developed to take advantage of retreading opportunities overseas. It has its own factories in Trinidad, Ghana, Nigeria, Uganda, Malaya and Singapore.

Other transport products

One of the best known sections of the Dunlop business other than tyres is the group of operating units in Coventry. This comprises the *Rim and Wheel Company*, the *Aviation Division, Brake Division, Suspensions Division* and *Redditch Mouldings Ltd,* which together produce a wide range of components for the vehicle, aircraft and other precision engineering industries. *The Rim and Wheel Company* is the largest firm of its kind in Europe. It has developed wheel production to a unique degree of automation, so that it is able to produce rims and wheels of every type and size in large volume while maintaining the highest possible standards of precision and quality.
The *Aviation Division* turns out a comprehensive range of components for aircraft, ranging from wheels and brakes to de-icing systems. Its equipment is incorporated in more than 70 aircraft in current use and is supplied to no fewer than 200 world airlines, apart from sales for military aircraft. Not surprisingly, it has earned a very high reputation for its world-wide service.
As early as 1945 the Company had introduced disc brakes for jet aircraft, and its work in collaboration with Jaguar cars in the 1950s led to the development of disc brakes for vehicles of all kinds and to the granting of manufacturing licences in several important countries.
The newest division in the Coventry group is the *Suspensions Division* originally formed to handle the large output of rubber suspensions and transmission couplings designed by Alex Moulton for the B.M.C. Mini, but it also produces Moulton 'Hydrolastic' suspension units for B.M.C. and a variety of other components for the car industry.

Consumer goods

As stated earlier, 'Dunlopillo' latex foam shares with the pneumatic tyre the distinction of being the most revolutionary product invented and developed by the Company. In the years since its introduction in 1929, 'Dunlopillo' has made a steadily increasing impact on standards of domestic and public comfort in a wide

Arnold Palmer in practice at Wentworth with one of his Dunlop-made golf clubs.

number of countries. Today, a similar product has made its appearance in the Company range; this is 'Dunlopreme' polyether, a chemical-based foam, which may be described as the synthetic complement of 'Dunlopillo'.

Another important section of the Consumer Goods Group consists of Dunlop sports goods, known all the world over. For instance, the famous 'Dunlop 65' golf ball, introduced by the *Dunlop Sports Company* as long ago as 1934, has had a uniquely successful career at competition and club level. Its popularity has recently been enhanced by the launching of a 'New '65' with even better performance. *The Sports Company* was also the first in its field to produce multi-ply tennis rackets (so much stronger and more reliable than the old unlaminated frames) in any quantity in Britain, and since the war its factory near Waltham Abbey in Essex has been greatly modernized by the introduction of new machines of Dunlop design to bring even greater precision into the flow-line production system. A mark of the quality so produced is to be found in the large number of Wimbledon competitors who put their trust in the 'Maxply Fort'.

A major development in Dunlop's sports manufacturing complex was the acquisition in 1959 of *Slazengers Ltd.* As far as policy and sales organization is concerned, *Slazengers* continues to be completely independent. For many years it has supplied the tennis balls for the Wimbledon Championships.

In 1960 the Company acquired a third sports company when *Edgar Sealey & Sons Ltd* joined the Group and brought with them their long-standing skill and experience in the manufacture of fishing rods and sporting hooks.

Here, too, is a convenient point to mention the Dunlop footwear manufacturing activities. At its factory in Walton (Liverpool) *Dunlop Footwear Limited* makes a wide range of rubber and canvas footwear—sports shoes, slippers, casuals and weather-boots—and here new processes are being introduced. For example, a large modernization programme has led to the introduction of new plant for the latest direct vulcanization, compression and P.V.C. injection moulding techniques, which will ultimately be applied to most of the footwear range.

Another Dunlop 'first' was when *Dunlop Semtex Limited* introduced thermoplastic flooring to the United Kingdom shortly before the war. Since 1950 the company has supplied and laid for the British building industry no less than 360 million square feet, enough tiles to girdle the earth three and a half times.

Until 1962 *Semtex* sold its products to the trade only, but in that year in response to the growing public interest in do-it-yourself techniques it turned its attention to the domestic market. The *Dunlop Semtex Retail Division* was created, producing an easily laid floor tile and a patterned sheet floor covering, both of which quickly became brand leaders.

All the company's products—with the exception of its carpet underlay—are now firmly based on P.V.C., a material which may form the base for the whole future of the flooring industry. Bearing in mind the current 'population expansion' and the ever-growing demand for housing, *Semtex* has undertaken an

expansion programme in which some £5½ million is to be spent on new buildings, machinery and other plant. This, it is hoped, will enable the company to keep pace with the insatiable need for building components.

Industrial products

Of equal interest and importance is the Company's contribution to industrial efficiency and safety, which is reflected in the products of a number of subsidiaries or divisions.

The *Belting Division* at Liverpool, for instance, is a major supplier of fire-resistant conveyor belting to the National Coal Board (Dunlop, incidentally, was one of the first companies to comply with the N.C.B.'s stringent safety regulations) and also of rubber conveyor belting to a host of industries. A recent company development in this field is a revolutionary type of pedestrian conveyor belt which may earn a place in the two-level towns of the future.

The first British moving pavement – the 'Speedwalk' installed at Leeds in 1964.

As one would expect, the work of the *Belting Division* is made easier by its close association with *Dunlop Textiles Limited* in Rochdale, especially in developing special purpose fabrics as well as fabrics of standard weights and strengths.

Another busy part of Dunlop is *Hose Division*, one of whose main products is suction and discharge hose for the oil industry. In fact, the Division supplies almost every type of industrial hose and, as in the manufacture of belting, increasing use is being made of man-made fibres. As far as the public is concerned, the Division's best known product is its range of colourful garden hose.

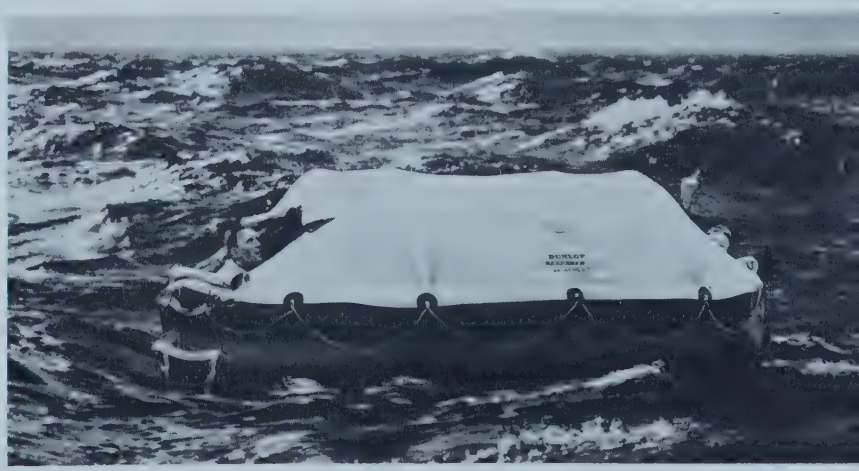
There is always something new in rubber, for which the Group can take no small part of the credit. Its *General Rubber Goods Division* makes a wide range of goods, varying from acres of rubber linings to domestic hot-water bottles. An instance of the way the Division is initiating advances is to be found in its process of laminating polypropylene to rubber to form a specially tough tank lining, which is resistant to corrosive chemicals at temperatures higher than ever before possible. Also noteworthy is the fitted rubber flooring made by the Division which under the names 'Hytone' and 'Veltone' is used in many different makes of private and commercial vehicles.

Dunlop Chemical Products Division is one of Britain's leading manufacturers of adhesives for industry, and of compounded latex (natural and synthetic) for use in the textile, carpet and man-made fibres industries. The Division is now also marketing a comprehensive range of new adhesives for the building industry. It has taken a leading part in the development of polyvinyl acetate emulsions and acrylic polymer emulsions, for use in the paint, textile and adhesives industries.

Further important products for industry come from the Company's subsidiary, the *John Bull Group*, which specializes in engineering applications of rubber. There are three companies in this Group, the *John Bull Rubber Co. Ltd, Metalastik Ltd,* and *Precision Rubbers Ltd.*

The Mechanical Products Division which supplies a large proportion of the motor industry's brake hose requirements, is also a

A D-type Dracone – containing some 10,000 gallons of kerosene – undergoing towing trials in the Solent. The Dracone is a flexible rubber container for the transport of bulk liquids by sea and various sizes are manufactured at the General Rubber Goods Division at Manchester. Also made at Manchester are inflatable liferafts already in use by ships and aircraft throughout the world.



One of the new Stockholm Underground trains with Metalastik rubber suspension.

leading producer of components in polyurethane rubber.

Metalastik Limited was the pioneer of metal to rubber bonding, and is still the leading exponent of the technique. Among the company's notable developments is the all-rubber springing for road and rail vehicles, including London Transport's silver tube trains, Midland Red buses and Stockholm's underground trains.

The third company in the *John Bull Group, Precision Rubbers Ltd*, specializes in the production of components in rubber to very fine dimensional tolerances, using natural and synthetic rubber and silicone materials. The company has developed a wide range of compounds to meet the needs of the Ministry of Aviation, War Office, Admiralty and British Standards Specifications, and for other special tasks.

There are further ways in which the Company is serving a wide variety of firms and public service utilities, but those just described are enough to indicate the versatility of the Dunlop Group. The number of new inventions, materials and processes pioneered by the Company throws into sharp relief what might be termed 'the Dunlop attitude of mind'—namely, the refusal to rest on past laurels, the quest for something new and better.


U.K. Factories
KEY TO SYMBOLS
Tyres
Retreading
Precision rubber products
Textiles
Sports goods
Flooring materials
Adhesives, Polymers
Ebonite products
Wheels, rims, adhesives
Car mats
Latex Foam products
Footwear
Hose
Belting
Chemical plant linings
Fishing rods, etc
Proofed fabrics
DUNFERMLINE
INCHINNAN
GLASGOW
JOHNSTONE
PRESTONPANS
LONDONDERRY
GATESHEAD
HARROGATE
KEIGHLEY
ROCHDALE
HORBURY
SKELMERSDALE
HINDLEY GREEN
LIVERPOOL
MANCHESTER
BARNSLEY
ECCLES
STOCKPORT
GRIMSBY
SHEPSHED
BAGWORTH
LEICESTER
DUDLEY
BIRMINGHAM
OLD HILL
COVENTRY
RAUNDS
REDDITCH
GREAT CHESTERFORD
BRYNMAWR
HIRWAUN
CWMAVON
BRISTOL
WALTHAM ABBEY
WEMBLEY
LONDON
NEWTON ABBOT

Manufacturing and Marketing – Overseas

From its earliest beginnings, the Dunlop organization has always been international minded. It was an attitude born well before the turn of the century when the Company had to go abroad for rubber, its main raw material, and the pattern has so developed since that today 60 per cent of the Group's assets are in overseas countries, and it is in these areas that the Group makes a substantial part of its profits. Essentially, then, Dunlop is an international organization though there is no fine division of its activities between home and overseas; rather there is a sense of common purpose and partnership from which the whole organization derives strength.

In its early days Dunlop led the trend towards internationalism in the tyre industry, with the formation of companies in France, Germany, Canada and Australia during the 1890s, and in Japan in 1909. Then, with the exception of the factory established in the U.S.A. in 1920, there was a pause until the thirties, when the expansion of road transport in a number of countries coincided with the protectionist policies stemming from the world slump. It was against this background that Dunlop built factories in Ireland, India and South Africa.

Since the war, many developing nations have sought to safeguard their economies and raise living standards by industrialisation. Tyres and other rubber products, which are necessary to daily life, offer particularly good opportunities for a successful pioneering industry, provided that capital and regular technical help can be made available.

Dunlop has helped to meet such national aspirations by establishing factories in New Zealand, Brazil, Rhodesia, Malaya, Nigeria and Uganda. The Group's most recent overseas company, Dunlop East Africa Ltd, was created in 1964 to produce bicycle tyres in a new factory in Jinja, Uganda. An exception to the usual overseas practice was in Malaya where the first factory was built solely for the production of 'Dunlopillo'. This was followed in 1962 by a tyre factory. In the same period, the Dunlop companies in South Africa, India and Japan have extended capacity by building new plants, and in many instances arrangements have been made for the participation of local capital. At the same time, the Company's manufacturing interests in the older industrial nations, France, Canada, and the U.S.A., have been expanding through the addition of new factories, and reference has already been made to T.E.R.C.O., our overseas retreading company.

These developments are not of course inspired only by social and economic motives; they are also strongly commercial and technological. To take but two examples, freight is often an important cost element in a competitive market, and differing service conditions can sometimes give a home-produced tyre, tailor-made for the particular country, an edge over the imported product.

The pattern of Dunlop development outside the United Kingdom has usually been the establishment of a tyre factory at first making certain types and sizes of tyres, followed by the widening of the range as the market developed, and finally, an extension of activities into consumer and industrial rubber products, described in detail in the previous chapter.
Our manufacturing interests fall conveniently into five main geographical areas.

Europe

With the coming of the motor car, Europe was a natural area for the extension of Dunlop activities outside the United Kingdom. And the factory at Hanau, near Frankfurt, rebuilt in 1904 following a disastrous fire, was among the first of the overseas manufacturing operations. In 1944, 60 per cent of the factory was destroyed, but by 1950 production had regained the pre-war level, and it is now the second largest tyre plant in Germany. But in addition to a full range of tyres, two subsidiary companies produce 'Dunlopillo' latex foam, a wide range of synthetic foam products and vinyl flooring. At present, over 6,500 people are employed in the Dunlop organization in Germany.
In France, Dunlop operations began even earlier in 1893 but it was not until the end of the First World War that the first tyre factory was completed at Montluçon. A wheel and rim factory was built at Le Bourget in 1930 and today Dunlop has four factories in France, producing in addition to tyres and wheels, 'Dunlopillo' products and flooring. The new tyre factory built at Amiens some six years ago is still among the most modern in the world with a high degree of automation.
In the mid 1930's, Dunlop were invited to establish a tyre factory in the Irish Republic to supply the whole requirements of the Irish market. The original factory at Cork has been extended several times to keep pace with the growing demand for tyres of all kinds, and today Dunlop still supplies all the tyres used in Ireland. But a wide variety of products is also manufactured there and in the last thirty years, the product range has been expanded to include footwear, 'Dunlopillo', golf and tennis balls and miscellaneous industrial and consumer rubber products such as hot-water bottles and sheeting.

The Americas

One of Dunlop's earliest overseas ventures was in the New World, when a factory was acquired in Canada, at Toronto, in 1894. It remains today as the headquarters of the Industrial Division. As the name implies, the Division produces a wide range of industrial rubber products ranging from conveyor and transmission belting, and hose to specially resistant linings for chemical plants. In addition, rubber footwear and cycle tyres are also produced there, although the bulk of the tyre production is now located in a modern factory built at Whitby some 30 miles outside Toronto, in 1957. And to meet the needs of the motoring public more efficently in this expanding and highly competitive market, the Company owns a chain of retail tyre stores throughout the country. The Dunlop family in Canada now numbers nearly 2,000 people.

Dunlop has been established in the U.S.A. since 1920, when a tyre plant was built at Buffalo, not far from the Canadian border. A textile mill followed soon after at Utica, and in 1960 production of golf balls was transferred to a completely new location at Westminster, North Carolina.

Although Dunlop have been associated with South America for many years, it was not until 1953 that a tyre factory was built in Brazil, at Campinas, some 30 miles from São Paulo, to produce a full range of tyres for the needs of the growing Brazilian market.

Africa

Dunlop's interest in Africa goes back before the turn of the century when a lone Irishman established a depot in Cape Town in 1896. Now with the opening of the cycle tyre factory in Uganda, the Company's interests in Africa amount to seven factories and some 15,000 acres of rubber plantations.

The lone Irishman not only sold tyres, he sold the idea of motoring. By 1935, the market had grown so rapidly that Dunlop built a tyre plant in Durban and thus introduced a new industry to South Africa, for previously South Africa had been dependent on the import of tyres from the U.K. and America. Today, the Dunlop factory is among the largest and most modern in the Republic and there are three other factories now in operation together employing some 3,700 people. At Benoni, near Johannesburg, all the Company's industrial rubber products and flooring are produced; 'Dunlopillo' and synthetic foam are manufactured in Port Elizabeth, while tennis, squash and badminton rackets are produced in a small but efficient plant at Pinetown, 12 miles outside Durban.

Industrial development came later to other parts of Africa but as the Rhodesian economy expanded rapidly after 1945, a decision was taken in principle to establish a tyre factory there. In 1958 that decision became an accomplished fact when a £2 million plant was opened in Bulawayo—the only tyre factory in that area—to manufacture a full range of car, truck and cycle tyres which are sold not only to the growing Rhodesian vehicle assembly industry but also to markets in Malawi and Zambia.

Across the other side of the Continent, the needs of the growing West African markets were not being overlooked. A major contribution to the Nigerian economy was made when Dunlop opened a tyre factory at Ikeja, in the Western Region of Nigeria, in 1962. This new enterprise, *Dunlop Nigerian Industries Ltd* had an issued share capital of £2 million and 40 per cent of the share capital was reserved for Nigerian participation. The factory employs some 750 people and supplies one of the largest markets for cycle tyres in Africa together with a full range of car and truck tyres.

The story of Dunlop in Africa is brought up-to-date by the establishment of the cycle tyre factory in Uganda referred to earlier.

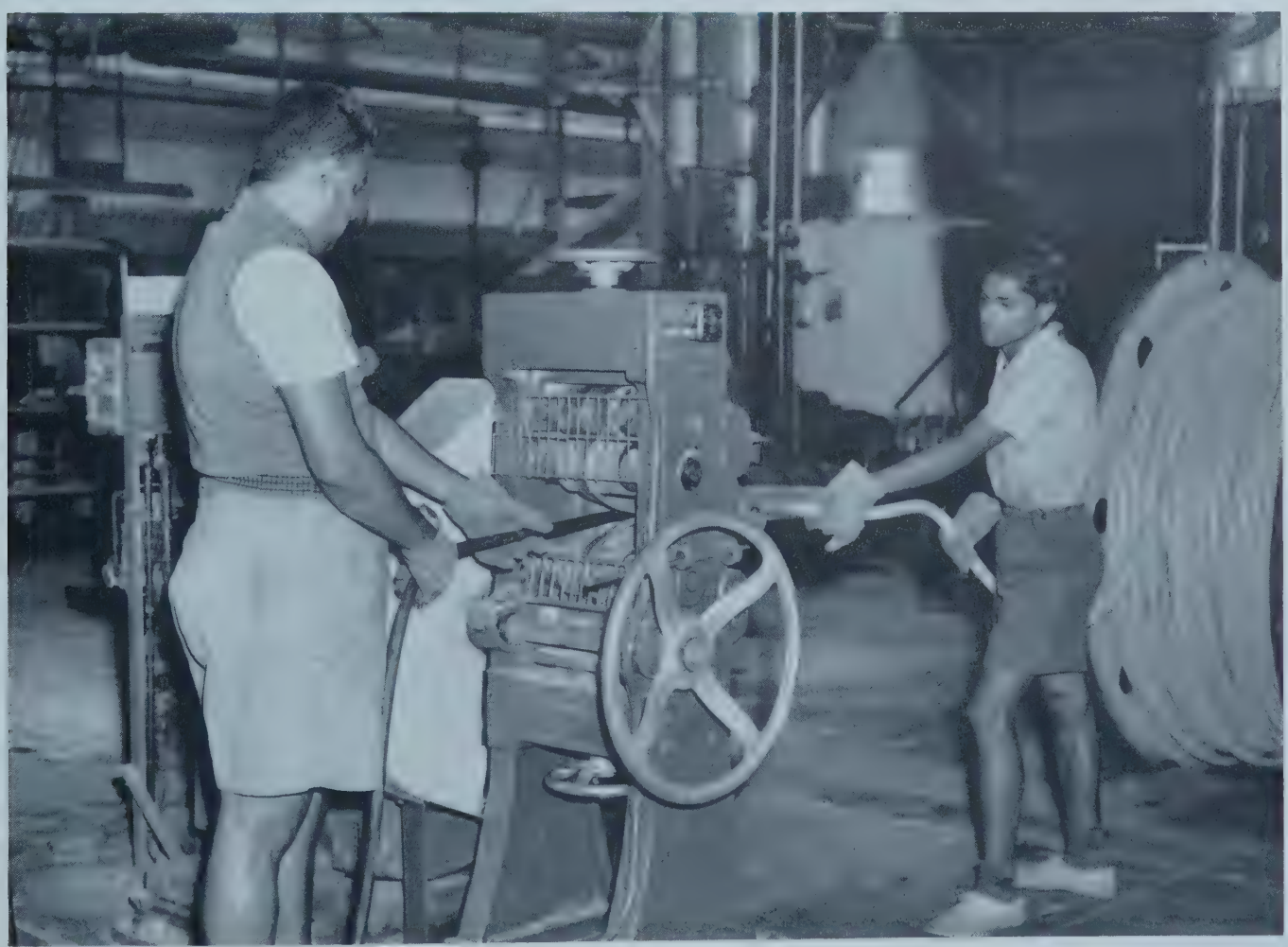
Asia

The Company's largest operating company outside the United Kingdom is in fact in India, where a tyre factory was built at Sahaganj, near Calcutta, in 1936. After the war, expansion plans

were quickly put in hand—first, the addition of cycle rims, then 'Dunlopillo', while conveyor and transmission belting, hose, adhesives and golf balls followed in quick succession. Certain types of tyre, such as tractor and aero, are still produced at Sahaganj but by the late 1950's the expansion of the tyre market led to the erection of a new factory at Ambattur where the major part of the tyre operation is now situated. As the vehicle demand continued to expand, a joint company was formed by Dunlop and local interests to manufacture wheels and rims. Production capacity at this factory, located near Madras and completed in 1962, has already been extended.

The Sahaganj factory differs in one important respect from other Dunlop factories; it has a residential estate including its own hospital, cinema, market place and schools.

Stripping the lead sheath off the finished hose at the Sahaganj factory..



Although Dunlop have long been established in Malaya, with one of the largest rubber estates in the Commonwealth, for many years the market for tyres was not sufficiently large to warrant domestic production and most of Malaya's needs were supplied by imports. However, in 1962, Dunlop opened the first tyre factory in the area at Petaling Jaya, near Kuala Lumpur, to serve the whole of Malaysia, and in 1964, a new 'Dunlopillo' factory was opened at Seremban to take the place of the earlier one at Bahau. Nearly 40 per cent of the capital of *Dunlop Malayan Industries Ltd* is owned locally and this partnership between Dunlop capital and know-how and local finance is a feature of the Dunlop operations in the modern world.

But Dunlop's first interest in Asia was a short twenty years after the Company began operations for in 1909 a factory was built at Kobe in Japan. New products were subsequently introduced ranging from hose and belting to sports goods but in 1961, a second factory was added at Nagoya to meet the needs of the rapidly expanding Japanese vehicle industry. *Sumitomo Rubber Industries Ltd,* as the Japanese company is now known, is a Dunlop associated company.

Australasia

As the earlier part of this chapter mentioned, Dunlop interests spread to Australia in the 1890's—the fourth country outside the United Kingdom. Today, *Dunlop Rubber Australia Ltd* is an associated company of the Group and produces a wide variety of products—tyres, 'Dunlopillo', flooring, footwear, sports goods and consumer and industrial rubber products at a large number of factories spread throughout the country.

Not quite so extensive are the activities of Dunlop in New Zealand where manufacture first started during the Second World War. In 1946, the first factory was officially opened at Woolston, near Christchurch, in the South Island and it now manufactures 'Dunlopillo', carpet cushioning, footwear components and general rubber products.

Soon after, a second factory was opened in the North Island at Upper Hutt, near Wellington, to specialize in tyre manufacture. Also located in Wellington is the Slazenger factory producing sports goods whilst farther north in Auckland, another Dunlop subsidiary produces a complementary range of sports equipment. *Dunlop New Zealand Ltd* has made a major contribution to the New Zealand economy and now employs over 1,000 people.

Organization

The pattern of Dunlop operations throughout the world consists, then, of the widespread activities of the manufacturing units, reinforced by a complex network of exports, mainly from the United Kingdom. Policy is based on two principles. First, products must be provided from the most appropriate source, taking into account technical suitability, cost, duty and freight. Second, products must be marketed by the methods most suited to local conditions.

The selling organization is therefore based in and fully adapted to the market concerned. It can vary from the sales department of

a manufacturing unit, through the Dunlop selling company importing from a factory elsewhere, to the independent importer working as an exclusive distributor. In many cases the Company has had a very long association with such distributors, who are often helped and advised by Dunlop representatives permanently resident in the more important territories or who may cover a group of markets from some central point.

Factory, selling company, distributor and representative are all kept in close touch with the London headquarters through frequent two-way visits, for the Company believes strongly in the value of a steady interchange of ideas, views and experience. An international undertaking must fuse a degree of local autonomy with measures necessary to conserve and direct efficiently its resources of management, technical skill and finance, particularly in support of its long-term plans. And so the decisions of Group Headquarters are mainly ones that move men, money and know-how—often to the ends of the earth.

Export achievements

Dunlop shares in, and has responsibilities arising from, the success of the British car and vehicle industries overseas. A large proportion of the bicycles, vans, trucks, tractors and, above all, cars leaving these shores go out on Dunlop tyres, and the provision of these is an important charge on our tyre factories at home and abroad. Replacing tyres many thousands of miles afterwards is a great business opportunity, but it is also a challenge.

Exports, then, have always been keenly pursued in the Company and with considerable success. Britain at present earns about £29 million a year in foreign currency from tyre exports alone, and Dunlop is the major contributor to this total.

Tyres, however, are by no means the only feature of the export performance. The Group makes valuable exports of aircraft components, for instance, both for replacements and for aircraft construction. Another important export line for Dunlop consists in its sports goods—more than 50 per cent of the Dunlop Sports Company's production of golf and tennis balls and tennis rackets and frames is exported to more than one hundred overseas markets. With overseas output added to the home total, the Group is the largest manufacturer in the world of golf and tennis balls.

'Dunlopillo', Semtex flooring, belting, hose, general rubber goods also do thriving business abroad, contributing to the figure of £22 million for annual Dunlop exports from the United Kingdom—excluding the £11 million worth of products which go abroad in the form of component parts for vehicles and aircraft. Export success depends, of course, on being able to keep ahead technically of local production, and with many nations now in process of building up home industries, the challenge becomes keener all the time.

Sometimes it is more profitable for the Company to sell know-how rather than products. *Dunlop Chemical Products Division,* for example, has developed a large number of techniques and formulae for polymers and adhesives, and it has been found

worthwhile to sell this information as a form of 'technical aid'. Another example of Dunlop technical aid comes from the *Rim and Wheel Company* which has designed and installed wheel production lines in India and Czechoslovakia.

Communications

It has already been stressed that the constant interchange of information between all sections of the Group is essential to its daily functioning, and all the more so in view of the strong international bias of Dunlop activities today.

This is true especially of technical information. Each manufacturing company overseas has its own technical development department, besides which there are research centres in Toronto, Hanau and Kobe which provide the Group with sensitive eyes and ears in the three parts of the world where technical ideas are at their most prolific—namely, North America, Europe and Asia. To give one straightforward example : the greater part of the cost of a tyre is in its material content, so the Group must learn quickly of any major developments in price, design or quality, or of new materials, or of new sources for established materials.

A great deal of international work depends on comparison, but this can be a delusion if like is not set against like, particularly where figures are concerned. The Group tries to ensure that systems of cost accounting, analyses of expenses and statistics in general are so devised that they do permit rapid comparisons of figures of all sorts from various markets all over the world. This is most useful to factories setting standards as pioneer manufacturers in a new market.

A random sample of the men and women who work in the Dunlop factories and offices spread over the globe would yield a fine and colourful miscellany. A Birmingham man would rub shoulders with a Tamil, a Canadian with an African; a Maori with a citizen of Buffalo, N.Y. Between the extremes, a comparison of home life, of social circumstances would be meaningless and worse. But Dunlop genuinely strives for good labour relations, and the basic lessons and principles established in the older sections of the business are used to set standards and methods which, the Company believes, offer fair conditions and the chance of job satisfaction for all employees.

New trading patterns

No truly international company can afford to ignore the emergence of new trading patterns all round the world—in Europe, and in South and Central America. Developments in Europe have been particularly rapid with the European Economic Community and the European Free Trade Area forging ahead despite disputes and disagreements from time to time.

Dunlop has long recognized the essential unity of Europe. The factory groups in France and Germany, founded early in the Company's life, have in recent years been brought together with their British counterparts and distributing companies in most of the other countries of Western Europe into a co-ordinated European organization. Dunlop is thus well poised to take full advantage not only of national initiatives and special needs but

also of the great strength deriving from Europe's economy as a whole. Problems of course remain not least those presented by political divisions, and new ones will arise. By forward planning and organization, however, Dunlop is ensuring that in so far as they can these will be overcome or lessened.
It may now be a cliché, but it is true that the horizon of industry is forever widening and that it behoves international companies to think increasingly in international terms. Today, the nations of Europe are accepting what Dunlop foresaw commercially more than sixty years ago—namely, that the nation state is too small a unit in which to realize one's full potential. In the interests of its employees and shareholders, the Company is thriving internationally, and in so doing it takes pride in being able to contribute to the economies of many nations.

Marketing

From this review of the world-wide activities of the Company, it is obvious that most of the important products made by Dunlop can conveniently be described as durable goods. And it is the Company's policy to sell on the high quality of its products as well as on the price. In a word—on value.
Although selling conditions vary from market to market, one factor is common to all—their increasingly competitive nature. This represents a challenge which must be met not only by precision in production, and thorough research, but also by a flexible marketing and sales organization, having, in the Dunlop view, five key features:

1. Accurate assessment of the market using the latest research techniques available so that as far as possible manufacture is kept properly balanced with demand.
2. Swift communication between the salesman in the field and top management.
3. Careful selection of staff, who must be trained to know the qualities of their products and to give constructive advice to their customers.
4. A free flow of information among those responsible for sales, production and research.
5. The fullest possible use of publicity to inform and attract customers.

Nigerian worker removing tyres from the vulcanising moulds at the £3,000,000 Ikeja factory of Dunlop Nigerian Industries Ltd.

This emphasis on communication both within the organization and with the customer means that changing market trends can be highlighted and even more important, anticipated. For the ability to anticipate customer requirements is the basis of a successful and sustained attack on any market.
The structure of the marketing and selling organizations vary, of course, from division to division and company to company according to the type of product and the type of market they serve. But the Group can, and does, improve its marketing methods by the interchange of ideas on sales problems in different markets and on their solutions.

Overseas Manufacturing Companies

	NAME	OPERATIONS BEGAN	DUNLOP HOLDING OF ORDINARY SHARES
			%
EUROPE	**FRANCE** S.A. des Pneumatiques Dunlop, Paris	1893	53
	GERMANY Deutsche Dunlop Gummi Compagnie, A.G., Hanau.	1893	100
	IRISH REPUBLIC The Irish Dunlop Co. Ltd., Dublin	1935	72
THE AMERICAS	**CANADA** Dunlop Canada Ltd., Toronto	1894	100
	UNITED STATES Dunlop Tire & Rubber Corporation Buffalo, N.Y.	1920	99
	BRAZIL Dunlop do Brasil, S.A., Sao Paulo.	1953	100
ASIA	**JAPAN** (Associated Company) Sumitomo Rubber Industries Ltd., Kobe.	1909	44
	INDIA The Dunlop Rubber Co. (India) Ltd., Calcutta.	1919	51
	MALAYA Dunlop Malayan Industries Ltd., Petaling Jaya	1956	61
AFRICA	**SOUTH AFRICA** Dunlop South Africa Ltd., Durban.	1896	70
	RHODESIA Dunlop Rhodesia Ltd., Bulawayo.	1959	100
	NIGERIA Dunlop Nigerian Industries Ltd., Ikeja.	1962	60
	UGANDA Dunlop East Africa Ltd., Jinja.	1964	100
AUSTRALASIA	**NEW ZEALAND** Dunlop New Zealand Ltd., Wellington	1929	60
	AUSTRALIA (Associated Company) Dunlop Rubber Australia Ltd., Melbourne.	1898	11

Including the United Kingdom factories, TERCO factories and latex processing units on the plantations, the Group had 111 factories in 1965.

RANGE OF PRODUCTS	CHIEF FACTORIES WITH DATE DUNLOP PRODUCTION STARTED
Tyres, tennis balls, Dunlopillo, wheels, rims and flooring	Montlucon (1919), Mantes (1949), Le Bourget (1930), Amiens (1959).
Tyres, repair materials, Dunlopillo, tennis balls, floor coverings.	Hanau (1904).
Tyres, footwear, Dunlopillo, golf and tennis balls, general rubber goods.	Cork (1935).
Tyres, belting, hose, general rubber goods, plant linings, sports goods.	Toronto (1894), Whitby (1957), Toronto (Slazenger).
Tyres, golf balls, mechanical products.	Buffalo (1920), Utica (1932), Westminster (1960).
Tyres.	Campinas (1953).
Tyres, hose, general rubber goods, tennis balls, golf balls, adhesives.	Kobe (1909), Nagoya (1961).
Tyres, Dunlopillo, belting, hose, cycle rims, repair materials, adhesives, wheels.	Sahaganj, Calcutta (1936), Ambattur (1959).
Tyres, Dunlopillo, repair materials, adhesives.	Petaling Jaya (1962), Seremban (1964).
Tyres, latex foam, belting, hose, repair materials, adhesives, general rubber goods, tank linings, soles and heels, floor coverings, golf and tennis balls, rackets.	Durban (1935), Benoni (1949), Port Elizabeth (1961), Durban (Slazenger).
Tyres, repair materials.	Bulawayo (1959).
Tyres.	Ikeja (1962).
Bicycle tyres.	Jinja (1965).
Tyres, repair materials, Dunlopillo, soles and heels, battery boxes, general rubber goods, adhesives, sports goods.	Upper Hutt (1949), Woolston (1946), Wellington (Slazenger), Auckland (Owen Eyre).
Tyres, Dunlopillo, hose, belting, general rubber goods, flooring, cycle rims, adhesives, plant linings, clothing, footwear, sports goods, aero wheels, cut thread, rubberized hair, plastics.	Adelaide, Bairnsdale, Bendigo, Ipswich, Melbourne, Nowra, Perth, Sydney (inc. Slazenger), Wagga-Wagga.

Research and Development

A business like Dunlop must keep constantly abreast of new developments in science and technology if it is to maintain a leading position in its varied fields of manufacture. First-class research and development facilities are essential if this is to be done effectively.

As mentioned earlier, the manufacturing divisions and overseas manufacturing companies in the Group have strong technical departments which are responsible for product development at this level. Backing them and the Company as a whole is the Central Research and Development Division, located in the Dunlop Research Centre near Fort Dunlop, Birmingham.

The Centre's main laboratories are fully equipped with the latest apparatus for the investigation of polymers, both rubbers and plastics, and of products made from them. There is a separate large building used as a pilot plant where new manufacturing methods can be tried out, and a Polymer Pilot Building where new rubbers can be made on a semi-manufacturing scale.

The Centre not only maintains close contact with the Group's similar establishments in Canada, Germany and Malaya, but also with the research organizations of other large companies and with universities and Government scientific departments. More recently, smaller Dunlop research units have been set up in Eire and Japan, following the Dunlop policy of keeping in touch with developments in those areas in which change is most vigorous.

Polymer Chemistry and Physics

One of the major technological trends of modern times is the extensive and increasing use of synthetic materials. This is taking place because the exacting demands on many products can no longer be met exclusively by natural materials. The chemistry of polymers is therefore one of the Division's major interests, particularly the production of new polymers and research into new ways of making existing ones.

Dunlop has taken a leading part in the development of the new ethylene-propylene rubbers which not only have outstanding properties but are potentially of low cost. More recently, the manufacture of the man-made equivalent of balata has been pioneered, and an entirely new class of rubbers, resins and plastics, called 'thiamers', is in the development stage.

The fundamental study of the relationship between the chemical structure of a material and its physical properties is of course a continuous feature of research at the Centre, and it has led to a deep understanding of the mechanism of rubber friction and the conditions for optimum road holding.

The exploration of new techniques must take its place alongside the development of new materials. New injection moulding techniques are being increasingly applied to the manufacture of Company products. New applications of vacuum forming have also been made, and an improved machine is on the market.

Again, new products based on the electrostatic deposition of precision-cut textile fibres on various surfaces are being manufactured, and further research and development is expected to widen this field appreciably. For scientific research and development engineering go hand in hand.
The Company is a large consumer of textile fibres in tyres, belting, hose and other products. Some of the modern thermoplastic textiles require carefully controlled heat treatment for their most efficient use, and a new application of 'fluid-bed' methods is expected to lead to the development of new machines.

Latex and foam

It has already been recounted how many years ago the Company pioneered latex foam which still successfully meets the demand for greater comfort in mattresses and upholstery. Large quantities of polyurethane foam are also produced, and long experience in foam markets has enabled the Company to expand both types of foam product simultaneously. As polyurethanes are used in a number of manufacturing lines, it is not surprising that the Research Centre pays these a lot of attention.
The Company's leading position as a producer and user of natural latex gave it a special lead in the synthetic latex field as well. A wide range of special latices of synthetic rubbers and plastics is marketed for adhesives, emulsion paints, carpet backing, paper treatment and textile-rubber bonding, and new products regularly emerge from the Centre's work in this field. Despite the emphasis on synthetic materials, the Malayan Research Centre, some thirty miles from Malacca, is not only

Grafting a bud from a high yield plant on to a young rubber tree in the Dunlop Malayan Plantations.

The Dunlop Malayan Research Centre near Malacca.

carrying out important work on natural rubber and latex, but on all the field aspects that make for efficiency in a rubber plantation. *Dunlop Malayan Estates Ltd* have recently diversified into the cultivation of oil palm, a development which is extending the field of research expertise in Malaya.

Despite its width of interests the Company's largest commitment is still tyres. The Tyre Division has a large technical organization which works very closely with the Research Centre. Most advances in materials, whether they be rubbers, plastics, or textiles, can be significant and new techniques, useful elsewhere, can be applied to tyres. Tyre physics, which spells out the contribution of the various components to performance, is the basis of scientific tyre design. The vast development in the last decade in vehicles and machines of all types that use tyres has itself led to what amounts to a revolution in tyre design and manufacture. Although this has been of great moment, the studies now being made are likely to maintain the momentum of this revolution in the years ahead.

The future

The range of products made by the Dunlop Group is given elsewhere in this publication. Its diversity is both a challenge and a fascination to research and development which responds in many ways. Close working, both formal and informal, between Research Centre and the technical departments of the manufacturing Divisions enables priorities to be set and ensures new developments get into production in the shortest possible time. Common materials and techniques form the link between lines of manufacture and consequently innovation in materials and techniques permit advances on a broad front.

With the expansion of the Dunlop Group, research and development facilities are also expanding both centrally in the U.K. and overseas. The rate of availability of new knowledge has demanded increased sophistication in equipment and instruments and improved channels of communication. Both have been provided. The close co-operation between Research Centre and Group Marketing Division increasingly enables profitable selection to be made from the wide and tempting possibilities uncovered by research and development.

It is no longer prudent, nor is it safe, to confine forward thinking to the immediate future. The speed of change and the planning of the Company's future operation demands forward projection as far ahead and on as sound a basis as possible—for today's research has an important bearing on the profitability of the Company at least five years ahead.

Work at the Centre

One of the most important features of the Company's structure is the group of central services operated for the use and benefit of the Group as a whole. These services include research and development which has just been described, purchasing, management services, marketing research, public relations and industrial relations. Further services cover legal and patents work, and staff training and administration to ensure, among other things, that promising men have the opportunity of obtaining the most suitable Company-wide experience. By drawing on their own expertise and experience from the individual divisions, the central services can often provide each division with a better service than it can build up for itself, and this is the key factor in deciding the extent to which Company services should be decentralized.

The supply organization

Each year there is a flow of materials, fuel, tools, components, equipment and machinery to the hundred and more Dunlop factories throughout the world, amounting to more than half a million tons of goods costing some £200 million. The number of items is in the region of 100,000, ranging from components as small as pins to as large as Banbury mixers, from materials as old as sulphur to as new as ethylene propylene rubber. Textile materials alone, in terms of yarn, would circle the world 5,000 times.

The task of co-ordinating the purchase and supply of these items falls to the *Materials Supply Division* located in London. Of course, the Dunlop purchasing network extends to many countries through the buying departments of overseas companies, and since the war many of these have become increasingly self-sufficient. Even so, there is still a large range of goods and materials which can be bought more economically through a central agency, so that some of the overseas as well as the home buying is co-ordinated by the Division. But the Group's policy is to centralize purchasing when—and only when— it is in the overall Group interest to do so.

Although the major raw materials are too numerous to mention individually, two are sufficiently important to digress at this point to discuss in more detail.

Nearly ninety per cent of the world's natural rubber production comes from South-East Asia. The two main producers are Malaysia, with over 40 per cent, and Indonesia, with 30 per cent. *The Dunlop Rubber Purchasing Company* based on Singapore, buys most of the Group's requirements of ready-packed rubber. A subsidiary company, *Dunlop Malayan Rubber Supply Company,* situated just outside Kuala Lumpur, takes care of special requirements by buying loose rubber which is sorted, graded and packed before despatch to the various Dunlop factories.

In recent years most of the Group's rubber supplies from its plantations have gone into the manufacture of 'Dunlopillo' foam, but more of the natural product will be sold on the world market as the Company makes increasing use of synthetic materials.

Synthetic rubber, as already noted, is being used by Dunlop on a large scale, the main types being styrene-butadiene rubber (S.B.R.) and neoprene and butyl. The first is the most important as it is used in tyres, but polybutadiene rubber, produced at Grangemouth in Scotland, is now beginning to take a share in the tyre market.

High tenacity rayon and nylon yarn are bought for conversion into tyre cord fabric by *Dunlop Textiles Ltd* and the company also buys raw cotton for manufacture into a host of products, including cycle cord, fabric, belting ducks, chafer and lining fabrics for tyres, hose ducks and some footwear fabrics.

To sum up, the role of the supply organization is to ensure that in terms of price, quality, delivery and service, the Company buys with the maximum economy and without prejudice to its wide interests throughout the world.

Marketing

In recent years the concept of marketing has undergone a radical change, its horizons have been considerably widened and the techniques available vastly increased. Today, in a modern go-ahead business, marketing means not only 'how to sell' but also 'what to make', and this requires that the design office and the laboratory, in addition to the sales department, bear the needs of the ultimate consumer continously in mind.

Since the war Dunlop in common with other companies has had to face the challenge of steadily increasing competition, therefore one of the main functions of its *Marketing Division* is to help the various operating units in the Group improve their skills and methods in this field.

The Division comprises three departments, one of which—*Marketing Research*—undertakes both economic and business forecasting, together with consumer and industrial market research for the various parts of the Group. The Department also helps divisions in the United Kingdom to develop their own skills in the research field, and is available for similar help and advice for Dunlop companies elsewhere.

While the responsibility for creating and implementing advertising programmes now lies with the operating unit concerned, the second leg of the Division, the *Central Advertising Department,* has an important role to fulfil. In addition to developing institutional advertising for the Group as a whole, the Department exercises a 'quality audit' function over all advertising to ensure that it conforms with Group policy.

The third leg of the Division, the *Public Relations Department*, is responsible for a wide range of services, including contact with the national Press, technical publicity and information services, including the production of films, photographic services and the Educational service. In ten years, one million educational book-

lets for use in schools have been distributed to primary and secondary schools, apart from Company technical literature which is widely used in Colleges of Advanced Technology and Universities.

Finance

One of the few common denominators in a diversified group operating all over the world is money—whether the currency is sterling or dollars, rupees or rands. And money is a particular concern of the *Finance Division* whose primary objective is to provide operating management with the financial information it needs to plan the activities of the company. To achieve this objective, the structure of the division has been adapted to the needs of a decentralized organization. Each operating unit has its own accountant who is responsible to the General Manager and who also has a functional responsibility to the Group Comptroller at the centre. Thus whilst the broad lines of financial policy are laid down by the centre, the divisional accountant, as a member of the local management team, provides the accounting services for the company or division.

In addition to establishing broad policy lines, setting standards and accounting procedures, the centre is also responsible for the financial affairs of the company, and for the preparation of the annual accounts of the Group. But apart from this traditional aspect of the division's work, it also co-ordinates the financial aspects of the management plans to enable the Main Board to see the implications in global perspective—not only in terms of current income and expenditure but also for capital projects. However, longer-term reviews of the availability and use of financial resources are also undertaken as part of the planning of the scope and direction of the Group's future operations.

More specialized services are provided at the centre—in particular the taxation department which is not only responsible for the tax affairs of the United Kingdom but also advises on taxation matters throughout the Group, and the internal audit function which is a critical and impartial review of the procedures and methods in use.

Management services

A business of the size and complexity of Dunlop must keep its management thinking and techniques under constant review. Coupled with the advent of computers, techniques such as organization and methods, operational research and value analysis offer the manager the chance of much greater control over a wide range of business tasks.

In Dunlop the development of these new management aids is undertaken by the *Management Services Division* which encourages operating units to adopt them, gives advice on some specific problems and helps in the appointment of consultants to investigate others.

The *Management Services Division* works in close collaboration with the Company's *Computer Division*, located at Fort Dunlop. Here are two Leo III computers which, together with their peripheral equipment, form one of the largest installations of its kind in the United Kingdom. It has been responsible for the develop-

ment and operation of advanced applications for the Tyre Group and other home divisions, principally in the fields of sales accounting, statistics, stock control, payrolls and cost accounting. The Division also helps in the solution of computer problems for the overseas manufacturing companies, notably on such problems as choice of equipment, planning of jobs and programming techniques.

Operational research is the term now in common use to describe the application of scientific principles and methods, notably those with a mathematical or statistical bias, to a wide range of management problems with a view to simplifying operations. In particular, it is used to provide logical bases for action, and it relies on a computer as a calculating tool. In Dunlop, a small operational research team, working mainly in the fields of production control and planning, is based at Fort Dunlop, from where it provides a consultancy service for use by any member of the Group. One of the major objectives is to ensure that the use of the most efficient methods spreads throughout the world organization.

Industrial relations

However trite it may sound, the Company has always recognized the key importance of good industrial relations, and for this reason advice and guidance from the centre is considered vital. This is the special responsibility of the *Group Industrial Relations Department*. The Department works closely with the operating divisions and companies, supporting their efforts to develop their own policies within the framework of the policy laid down by the Main Board.

The Department is divided into four sections. The Industrial Relations Officer (Europe) is responsible for the United Kingdom section of the Company and for the exchange of information with Dunlop companies in Ireland, France and Germany. The Industrial Relations Officer (Overseas) is responsible for contacts with the remaining companies in the Group and for keeping in touch with world trends in the field. Third, there is a senior manager whose duties cover safety, health and welfare and who maintains expert services to all parts of the Group. Lastly, there is another section specializing in research into personnel and labour relations problems.

In one sense the most important of all the Dunlop central services is the investment of time and money and effort in improving the skills and raising the job calibre of the employees. How Dunlop tackles this problem through a multiplicity of training schemes and courses is described in detail in the next section. It need only be said here that training is available to all levels of employees, from apprentice and operative to senior manager.

People

The ever-increasing tempo of change in industrial techniques, means that more and more value is placed on the men and women who work and manage the highly-mechanized modern factories. Dunlop has never under-rated the contribution of its 100,000 employees, working in more than thirty different countries, to the growth and profitability of the Company. But to ensure that the right people are always available in the right place at the right time, the company must have a sound co-ordinated personnel policy. This policy is based on careful selection of employees, their training or re-training, fair rewards for effort and ability, joint consultation, reasonable stability of employment and good working conditions.

Training

The range of products from Dunlop factories is so diverse that there is a continuing problem in providing the different types of skilled workers and specialists. The Company believes that self-help is the solution to a marked degree. This policy is based on attracting school-leavers for apprenticeship training, as well as recruiting skilled operatives and graduates. Separate apprenticeship schemes cover all the main factories, and the plants at Birmingham and Coventry each have modern apprenticeship training schools. Opportunities for employees to equip themselves for promotion exist at all levels. Younger men are encouraged to acquire technical or professional qualifications at the Company's expense.

Internal training provides for a wide range of instruction ; courses for operatives and foremen, induction training, computer appreciation sessions and management development programmes all help to keep the Group abreast of progress. As part of the training programme, Dunlop makes use of external courses at technical colleges, at universities and at business management schools. Many executives go overseas at an early stage in their career to widen their experience, and to an increasing degree the staff of manufacturing companies are attached to divisions in the United Kingdom and to the centre thereby equipping them for senior appointments in their own countries.

The Company's policy is to fill vacancies by promotion from within as far as possible. Training assists this process, and equally important is the regular assessment of employees by junior management and supervisory staffs always looking out for operatives who show special aptitude, or the annual appraisal and interview for senior staff and young men likely to merit above-average promotion. The development of people has brought its dividends ; general managers appointed in recent years have had such varied beginnings as junior production foreman, production planner, chemical laboratory assistant, sales trainee, engineer and cost accountant.

Regular Review

The declared aim of the Company is for improvements in efficiency and productivity to be coupled with good and improving wages or salaries, which are well-earned. The basic wages for operatives, at home and overseas, are agreed with the unions concerned, but in addition there are piecework and bonus schemes which ensure that skill and diligence are rewarded. All staff appointments are evaluated to determine the job-worth; a salary bracket is then set to enable the salary progression of the individual to be planned through regular review.

Dunlop realizes that job security depends on achieving increasing sales in the face of increasing competition. Since this in turn depends on the contribution from the individual employee, the Company believes in wide communications throughout the organization. For this reason, informal consultation between the employee and his foreman or manager is encouraged. Formal consultation is also widely practised throughout the Group; in most units there are joint consultative committees which deal with such topics as the application of national agreements, production problems, working conditions and accident prevention. The aim is also to improve the conditions of work and welfare benefits including the provision of canteens, medical centres, and sports and social clubs.

The same pattern of amenities are found throughout the world in the Dunlop Companies, whether it be in Malaya or France, Nigeria or Canada. On the plantations in Malaya or Nigeria, the Company provides housing for staff and workers, and has built schools and hospitals. In many cases several generations of one family will have lived and worked on a Dunlop estate. Likewise in India, for at Sahaganj, the factory has its own township for workers, with two schools, a hospital and a cinema.

The Group's personnel policies have one main aim, to ensure that Dunlop attracts and retains the standard of employee at every level of responsibility, to meet the challenge and demands of the technological age in which we live.

Postscript

Readers skilled in numbers may have calculated already that, quite apart from long-standing suppliers and consistent customers, there are nearly two hundred thousand shareholders, directors and employees in the Dunlop commonwealth. They may also have perceived that there are two hundred thousand individuals.

This individuality is important in Dunlop. It helps to explain why the Company believes in the superiority of competitive enterprise. No matter how vigorously it is pursued, that enterprise, touched with imagination and understanding, better inspires and fulfils the individual than any other system; and it is the best formula yet devised for the first aim of business, the steady creation of wealth.

Part of the complex installations at the International Synthetic Rubber plant at Fawley.

Principal Companies

Dunlop Rubber Company Ltd

Aviation Division, Coventry.
Belting Division, Speke, Liverpool.
Brake Division, Coventry.
Dunlop Chemical Products Division, Castle Bromwich.
Dunlopillo Division, Pannal, Harrogate.
General Rubber Goods Division, Manchester, Hindley Green and Skelmersdale.
Hose Division, Gateshead.
Overseas Division, London.
Tyre Division, Fort Dunlop, Speke and Leicester

Subsidiaries

UNITED KINGDOM

Manufacturing Companies

Dunlop Footwear Ltd., Walton, Liverpool.
Dunlop Rim & Wheel Co. Ltd., Coventry.
Dunlop Sports Co. Ltd., London and Speke.
Dunlop Textiles Ltd., Rochdale.
Edgar Sealey & Sons Ltd., Redditch.
India Tyres Ltd. (and subsidiaries), Inchinnan.
John Bull Rubber Co. Ltd. (and subsidiaries), Leicester.
John Letters & Co. Ltd., Glasgow.
Redditch Mouldings Ltd., Coventry.
Regent Tyre & Rubber Co. Ltd., Edmonton, London.
Dunlop Semtex Ltd., Brynmawr.
Slazengers Ltd. (and subsidiaries), London.
Tyre Equipment & Reconditioning Co. Ltd., London
TyresoleS Ltd. (and subsidiaries), Wembley.
United Reclaim Ltd., Speke.

Selling & Other Companies

Bintex Ltd.
Dunlop Plantations Ltd.
Dunlop Rubber Co. (Scotland) Ltd.
Marsham Tyre Co. Ltd. (and subsidiaries).
Tyres (Scotland) Ltd. (and subsidiaries).
TyresoleS (Overseas) Ltd.
W. Briggs & Co. Ltd. (and subsidiaries).

OVERSEAS

Manufacturing Companies

Deutsche Dunlop Gummi Compagnie A.G. (and subsidiaries).
Dunlop Canada Ltd. (and subsidiaries).
Dunlop do Brasil S.A.
Dunlop Malayan Estates Ltd.
Dunlop Malayan Industries Ltd.
Dunlop New Zealand Ltd. (and subsidiaries).
Dunlop Nigerian Industries Ltd.
Dunlop Nigerian Plantations Ltd.
Dunlop Rhodesia Ltd. (and subsidiaries).
Dunlop Rubber Co. (India) Ltd.
Dunlop South Africa Ltd. (and subsidiaries).
Dunlop Tire & Rubber Corporation.
Société Anonyme des Pneumatiques Dunlop (and subsidiaries).
The Irish Dunlop Company Ltd.
Dunlop East Africa Ltd.

Selling & Other Companies

Dunlop Rubber Purchasing Co. Ltd. (Singapore).
Dunlop Gummi G.m.b.H. (Austria).
Dunlop Rubber Co. (Continental) Ltd., Belgium.
Dunlop Rubber Co. A/S (Denmark).
Societa Italiana Dunlop.
NV Nederlandsche Dunlop Rubber en Banden Mij.
Dunlop Rubber Co. A/B (Sweden).
Dunlop Pneumatik Co. AG (Switzerland).
Dunlop Pneumatic Tyre Co. (S. America) Ltd.
Neumaticos Dunlop S.A. (Peru).
Dunlop (Ceylon) Ltd.
Dunlop Rubber Co. (China) Ltd.
Dunlop Rubber Co. (Indonesia) Ltd.
Pakistan Tyre & Rubber Co. Ltd.
Dunlop Nigerian Industries (Sales) Ltd.
Dunlop Malayan Rubber Supply Co. Ltd.
Dunlop Zambia Ltd.

ASSOCIATES

The International Synthetic Rubber Co. Ltd., Southampton.
Lastex Yarn & Lactron Thread Ltd., Birmingham.
F. Hurtley & Son Ltd., Keighley.
Dunlop Rubber Australia Ltd. (and subsidiaries).
Manufacture Francaise de Fils Elastiques Ltd.
Sumitomo Rubber Industries Ltd.
Wheels India Ltd.

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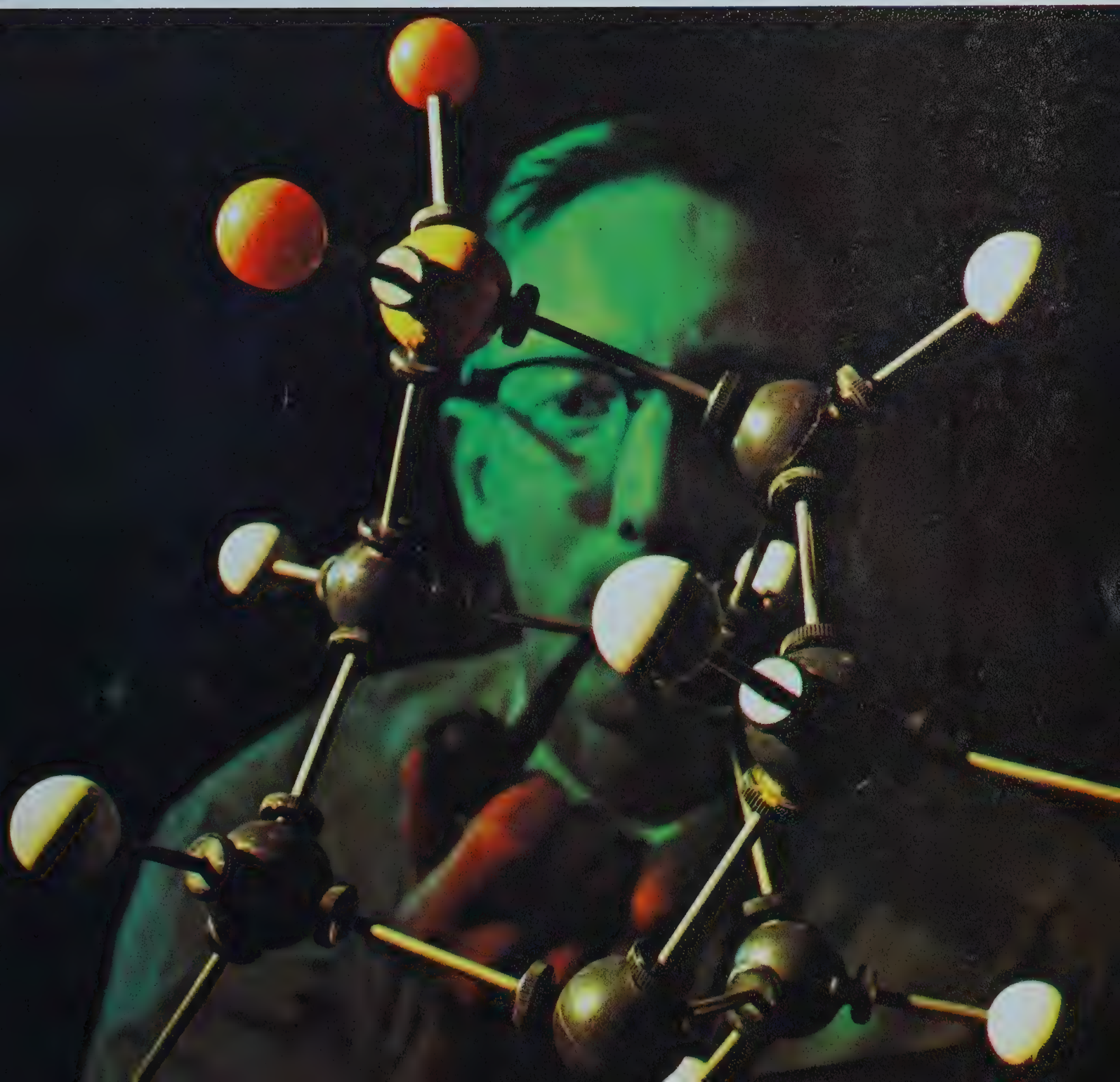
DUNLOP

IRM

Industrial Rubber Magazine

Autumn 1965



AUTUMN ISSUE—1965
Reference No. 6503

DUNLOP
IRM
Industrial Rubber Magazine

Commemorative issue
published by
Dunlop Canada Limited

Dunlop North American Research

Hon. Stanley J. Randall,
Ontario Minister of Economics and Development.

Mr. Reay Geddes, O.B.E.,
Managing Director, Dunlop Rubber Co. Limited.

Dr. Norman S. Grace,
General Manager, Dunlop Research Centre, Sheridan Park.

Sheridan Park Research Community, September 28th, 1965.

In a ceremony which marked the culmination of years of planning, the doors of Canada's newest research establishment were opened today.

The new Dunlop Research Centre at Sheridan Park, Ontario was formally declared open by the Hon. Stanley J. Randall, Ontario Minister of Economics and Development, before some two hundred guests from science, industry and government. Representing the Dunlop world organization and delivering the keynote address was Mr. Reay Geddes, Managing Director. Accompanying him from England were Mr. E. W. Madge, Director of Research and Mr. E. A. Murphy, former Director of Research.

Mr. George F. Plummer, President of Dunlop Canada Limited, and Dr. Norman S. Grace, General Manager of the Dunlop Research Centre were hosts to the gathering.

Dedicating the new Centre was Professor H. F. Mark, Dean of Faculty from the Polytechnic Institute of Brooklyn, one of the founders of polymer science. Also from the United States, was Mr. J. M. Billane, President of Dunlop Rubber Co., Buffalo, N.Y.

PATHFINDER FOR NEW PRODUCTS

In his speech, the Hon. Stanley J. Randall emphasized strongly his belief that Canada's economic future was tied securely to her ability to produce and export industrial products and services. Commending the Dunlop organization for the initiative so tangibly demonstrated in the creation of the new centre, he added that "research institutions of this type will do the pathfinding for new and better products to make Canadian industry a leading world trader".

INVESTMENT IN YOUNG CANADIANS

"Dunlop is not merely investing in the future prosperity of its own company," added the Minister, "but is investing in the people of Canada and particularly young Canadians — our leaders of tomorrow. Centres such as this will not only ensure that our industries remain competitive, but, perhaps more important, will allow Canadian graduate students to find both challenge and creative opportunity within their own country."

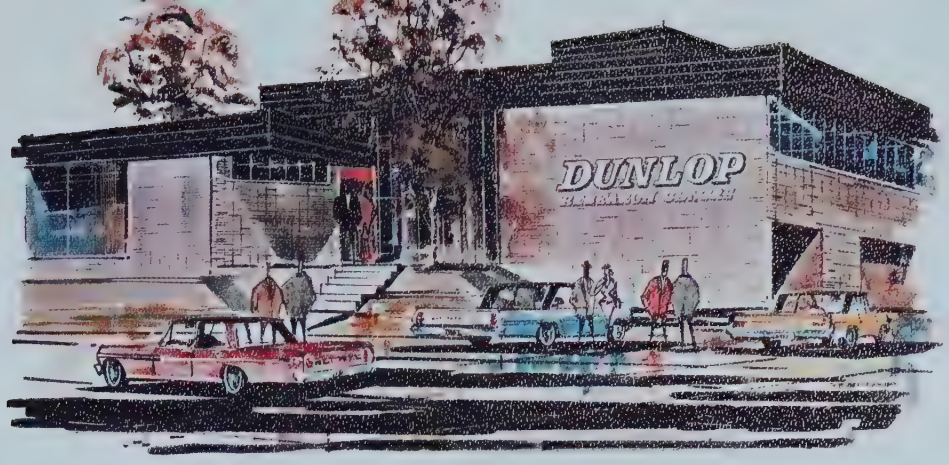
SCIENCE KNOWS NO BOUNDARIES

Last year, the world-wide Dunlop organization achieved record sales and earnings, launched its 111th factory, and opened up a wide lead in rubber technology — events which justly gave a feeling of satisfaction to Reay Geddes, Dunlop's chief executive, who delivered the key address.

Citing the Nobel lists as an example of the international flavour of science, Mr. Geddes pointed out that invention and discovery were not the prerogative of any one race or nation. A world-wide organization such as Dunlop was made up of many companies, in many countries, and the Dunlop research units were truly the connecting bridge which effectively linked them into one cohesive group. Scientific developments were thus distributed to members of the group. He continued "For an international organization, there are few better ways of being known than through its research units and their reputation."

IMPACT ON INTERNATIONAL SCENE

In conclusion, Mr. Geddes said "The concept of the Ontario Research Community, the support of the National Research Council of the Canadian Government, the encouragement of the Provincial and Federal Governments themselves, and the interest of so many industrial organizations will not only result in the increasing development of Canadian science and scientists, but will ultimately have a major impact on international science and research as a whole."



Centre Opened

UNIQUE RESEARCH FACILITY

The new research centre, the only one of its kind in Canada, is located 17 miles west of downtown Toronto at the new Sheridan Park Research Community. A modern split-level building, the new centre provides 19,000 square feet of functional space for offices, laboratories, library and conference rooms.

There are no less than 10 fully-equipped laboratories. Two on the lower level are specially constructed reactor rooms. These two laboratories have half inch boiler plate walls and windows that blow-out if excessive pressure is built up in the labs. The scientist controls the mixing of chemicals in the reactor with a series of dials located behind the armoured walls.

The centre also includes a lecture-conference room equipped for film projection and a well-stocked library and reading room plus many special raw material service and store rooms. An impressive feature, but one normally out of sight, is the vast underground subway, with hundreds of branching ducts carrying a network of engineering services to the various laboratories. A special air conditioning system completely changes the air every 6 minutes and, unlike conventional systems, the air is not re-circulated.

Included in the quarter million dollars worth of equipment is a Davis Machine. This unusual machine, the only one in North America, measures the energy lost in rubber under stress. It helps determine the best use for different types of rubbers and therefore helps Dunlop build better products.

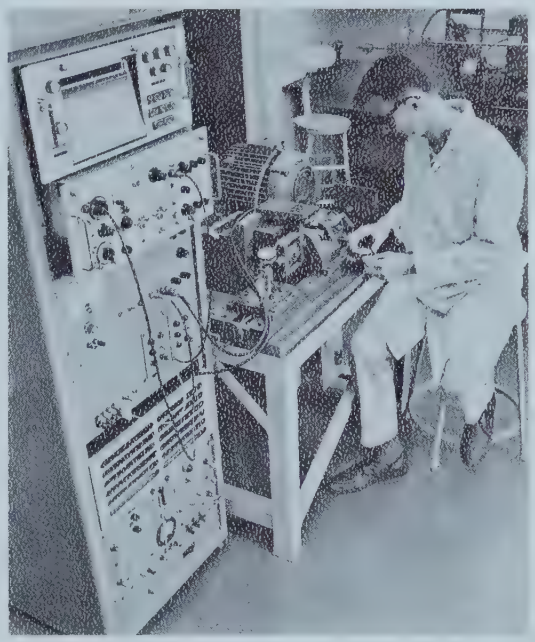
Another interesting piece of equipment is the High Shear Viscometer used in the study of pressure and temperature effects on rubber and plastics. With the Viscometer, more exacting information on the properties of newly created materials can be isolated and their possible uses and limitations revealed.

Five of the Dunlop laboratories are devoted to a continuing programme of chemical research seeking to improve the qualities of existing polymers and to develop completely new ones. Much of this research is based on entirely new raw materials, those not listed in any textbook. This research explores and develops chemicals that have never before existed.

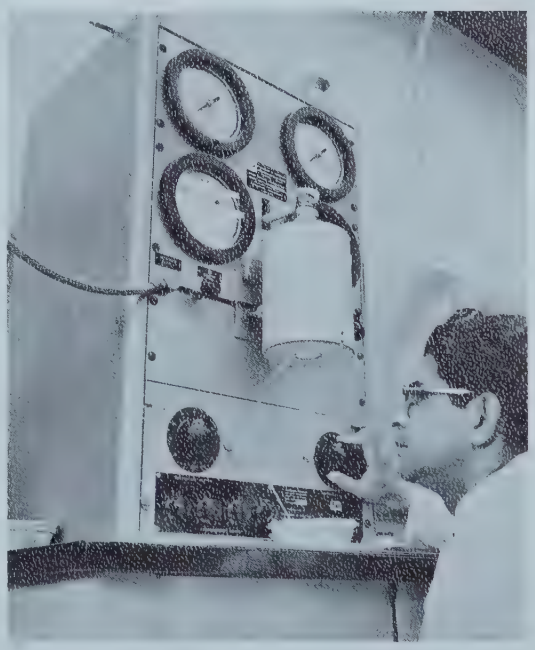
Appropriately, the Dunlop researchers work under a roof made from one of their own major discoveries, EPT, a new man-made rubber notable for its resistance to the effects of weather. The layer of EPT is secured by a Dunlop adhesive to the insulated steel roof deck. Since its discovery by a Toronto-based research team, EPT has been put into production on conveyor belts, garden hose and steam hose. Other industrial applications are expected.

The large technical staff is headed by Dr. Norman S. Grace who will take office as Chairman of the Division of Rubber Chemistry of the American Chemical Society, the first Canadian to be so named. Currently, he is Chairman of the Canadian Research Management Association, a Director and Vice-Chairman of the Sheridan Park Association and a Director of the Sheridan Park Corporation.

The Centre's work is largely exploratory research. Its programmes are usually nominated by the Dunlop research group in Canada, and are then examined from the scientific and economic point of view by both Dunlop Central Research in England and by the Canadian group. As a programme advances, it is reviewed periodically to decide whether it should continue, be accelerated or be dropped. Currently the Centre is engaged in work on sulphur-bearing polymers, in which important original discoveries have been made.



Davis Machine measures energy loss in rubber under stress.



The extrusion characteristics of new thermoplastics can be evaluated on High Shear Viscometer at varying temperatures and pressures.

The Significance of

In this age of scientific expansion, no company of the size and complexity of Dunlop can afford to be without first-class research facilities, and the opening of the Sheridan Park Research Centre is evidence of how important we consider the expansion of this basic part of our activities to be.

Dunlops' North American Research Centre was first established in 1954, using space in Dunlop Canada's Toronto plant until the Sheridan Park facility was completed. It is staffed by scientists and technicians who maintain close contact with the research organizations of other large companies, and with the universities, as well as with their colleagues in the research groups in England, Germany, Japan and with the Research Centre of Dunlop Malayan Estates Ltd. In addition, specialist consultants of international standing advise the Centre on specific research matters.

Research is a continually expanding universe. Every question answered raises another host of questions yet unanswered, calling in turn for increased research facilities, and scientists to use them. Today, we live in an age of scientific and technological advances of a scale and speed never before experienced by man. We are approaching frontiers of space now, which a decade ago would have seemed as impossible as television would to a citizen of 1765. We are growing accustomed to the impossible becoming commonplace.

While, understandably, the amazing and imaginative developments in space technology are those which attract most public attention, research undertaken by companies such as Dunlop plays a vital supporting role in the expansion of our economy. An expansion and creation of the wealth which not only benefits us all, but enables the costly national space programmes to be undertaken.

Broadly, the task of the Research organization is to provide the Dunlop group with its new technology to enable the development of better, less costly goods and services. More specifically, its purpose is to gain new scientific knowledge, to develop and draw attention to new raw materials and techniques and to expand the usage for existing materials and processes.

Predominantly, though by no means exclusively, the efforts of the Research organization are directed to polymer research. Most notable in this area of activity is the growing trend to the use of synthetic materials in place of the natural products which were exclusively used just a short while ago. This is not a matter of substitution of an inferior material. Rather, as the world's knowledge increases, man-made materials with superior qualities become available, and it is the Research organization's responsibility to direct the use of such materials to the customer's advantage. Again, as population and usage multiply, sources of natural products become limited and costly, and new synthetics must be sought out on a planned basis to meet this increasing demand.

SYNTHETIC RUBBERS

The variety of man-made rubbers is now large and growing, each with its particular useful and specific characteristics. Dunlop has its own pilot plants where such rubbers have been developed to enable finished rubber products to stand up to the severe demands of today's conditions. An example is Dunlop's Hi-Mu rubbers which were designed to meet the higher requirements of road safety with increasing traffic density and road speeds. Built into this range of synthetic rubbers are characteristics permitting improved road-holding, greater tire skid resistance on wet roads, better cushioning and greater braking power.

This particular development arose out of a fundamental study of the relationship between a rubber's molecular structure and its resulting

Research

physical properties. A good research programme requires its proper proportion of such fundamental work, for basic scientific knowledge is the spring from which new developments flow. A number of scientists therefore are engaged in fundamental research on such matters as the uses of high energy radiation, the properties of materials when under dynamic conditions, the relationship between chemical structure and physical properties, and others.

TEXTILES

The areas of research activity are, as already stated, by no means confined to rubber — indeed they are completely unconfined. For example, most rubber products contain significant quantities of textile reinforcement. At one time such reinforcement was exclusively cotton, but in recent years we have seen the development and use of high strength light weight synthetic textiles. Probably the introduction of rayon cords during the years of war shortage was the first major move to synthetics, but since that time nylon, Terylene and of course, blended weaves of different synthetics designed for specific conditions such as high impact, have largely displaced the natural fibres.

The constant evaluation of such textiles is a major research function, as is the development of techniques for their more efficient use. For example nylon cord requires precise and carefully controlled heat treatment and a new method of doing this has been developed which gives much improved cord properties.

PLASTICS

Another area of research activity which is growing is the evaluation of developments in plastics technology. As each new plastic comes along, particularly the flexible plastics, it is examined for its potential use in Dunlop products. A considerable number of such plastics are now incorporated in the product range offered by the Company, such as Dunclad PL, a laminate of chemical-resistant, non-toxic polypropylene and rubber, which is used for the lining of process vessels and tanks in the chemical, food and pharmaceutical industries. Other plastics have been blended with rubbers to produce high gloss, abrasion-resistant rubbers for specialized services, and plastic surfaced rubber conveyor belts have been developed for conditions where fire is a hazard.

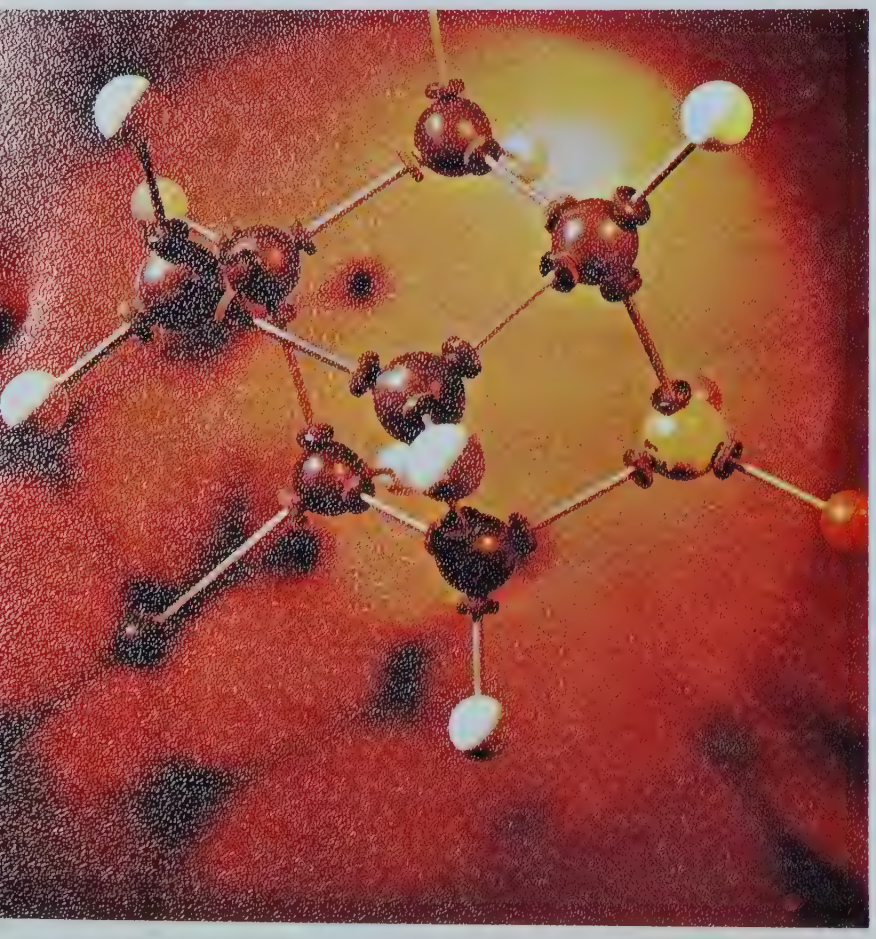
PRODUCT QUALITY

While the relationship between research and the manufacturing divisions is close, certain lines are necessarily drawn in order to protect the detached atmosphere so important to meaningful research operations. For example, the manufacturing divisions must control their own technical departments and laboratories whose main duties are to maintain quality, develop their own particular lines of manufacture and manufacturing processes, and control their own raw materials.

So far as day to day work of this nature is concerned, the research organization provides regularly one basic tool — chemical analysis guidance. Even such a mundane activity as this feels the "winds of change". Techniques which were suitable a few years ago are no longer usable in the face of new materials and processes. New methods of chemical analysis have continually to be devised to meet the Company's problems.

RESEARCH ALWAYS CHANGES

These then are just some of the functions, and some indications of the importance of research to the Dunlop Company. It was with this understanding of the necessity for an unending search for knowledge that the Sheridan Park Centre was planned. It is with appreciation that the work done there will largely determine Dunlop's strength in the years to come, that it was completed.



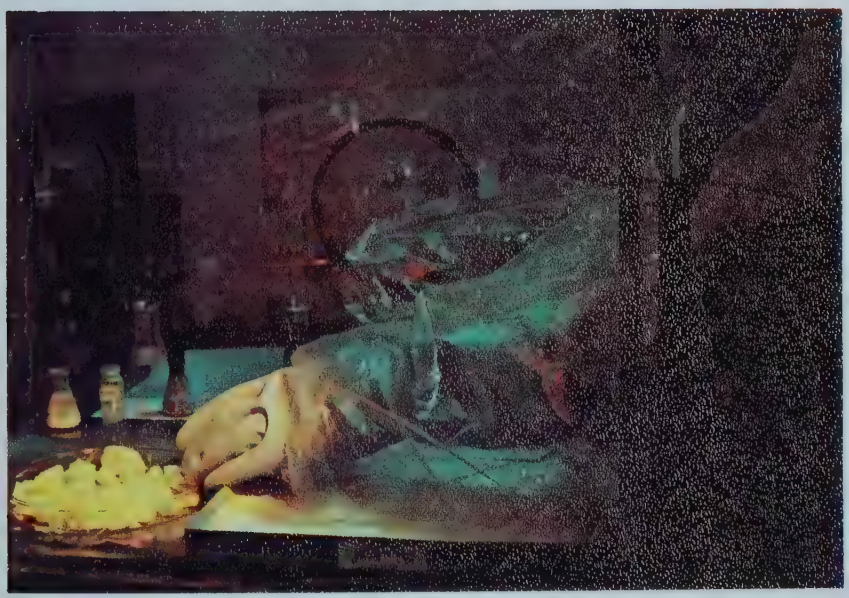
Critical Thinking
the key to meaningful research

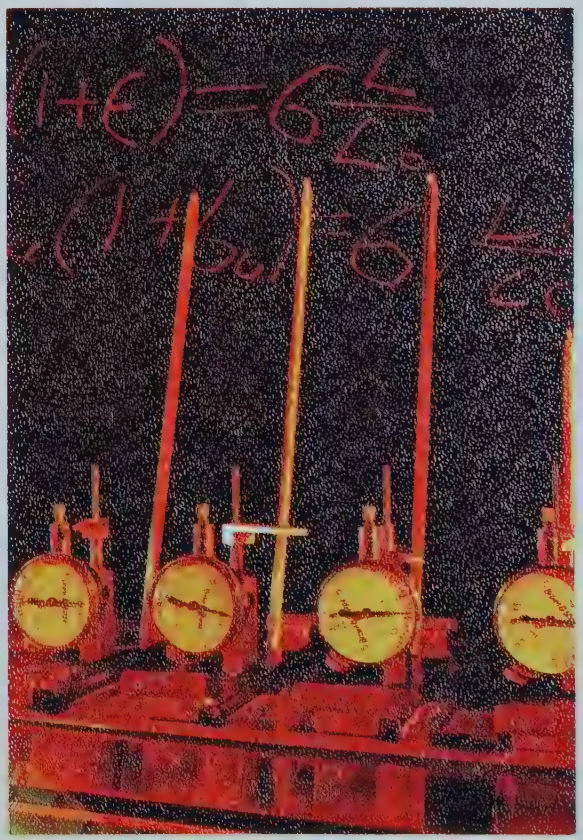
Research needs equipment, sophisticated and expensive equipment, and evidence of this requirement is clearly visible during a tour of the new Dunlop Research Centre. Here, some of the most delicate, intricate and closely calibrated instruments can be seen, most of them — in spite of their obvious complexity — designed for a fairly limited range of operations.

However, a building is only a building and a piece of equipment, no matter how involved, is only the brainchild of a man, devised to help him extend his thinking. The true basis of research is man's own thought processes. This is clinical, analytical, distrustful thinking of the kind that not only observes the result of a set of conditions, but searches out the reasons for this result and the cause of the conditions.

Critical thinking is a flower that rarely thrives in a busy street. It needs a controlled atmosphere and protection from disturbing distractions. One of the major advantages of the Ontario Research Community at Sheridan Park is the opportunity it affords to set this kind of background to research-oriented thinking. Here, in a campus-like environment, researchers in many fields are assembled with the opportunity of conferring on similar problems and of sharing one of the world's finest research library facilities.

. . . "the stimulation of ideas and the ability to generate continued freshness of approach are the lifeblood of research" . . .
Reay Geddes





September 28th . . .

Opening Day

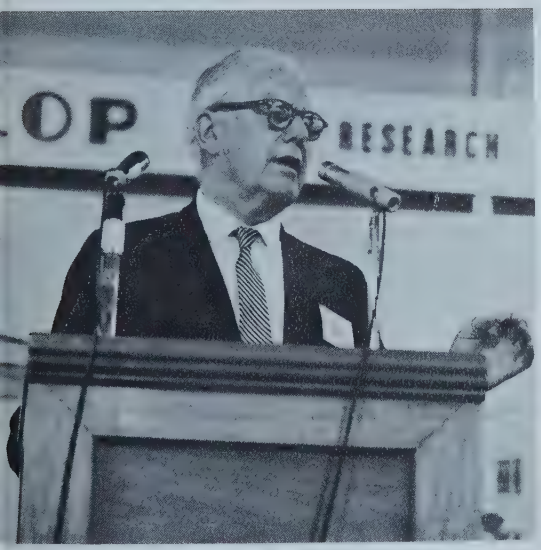
Opposite Page: *In one small group stand most of the men whose planning and foresight were responsible for the new Research Centre. From left to right, Mr. J. A. Carr, Assistant General Manager of the Centre; the General Manager, Dr. Norman S. Grace; Mr. E. W. Madge, overall Director of Research for the Dunlop group of companies. and Mr. Reay Geddes, Managing Director of the Dunlop organization;*

Upper Left: *An eminent figure in the rubber industry, Professor H. F. Mark, Dean of Faculty from the Polytechnic Institute of Brooklyn, dedicated the new research facility.*

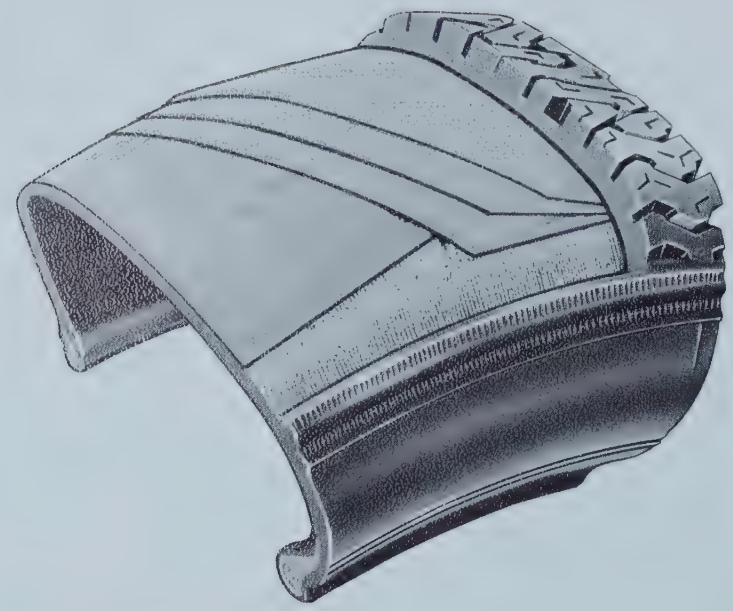
Upper Right: *Mr. George F. Plummer, President of Dunlop Canada Limited, who, along with Dr. Grace, served as host to the distinguished guests.*

Lower Left: *Part of the large gathering can be seen as Dr. Grace speaks from the podium.*

Lower Right: *During the tour which followed the formal ceremonies, the Hon. Stanley J. Randall, Ontario Minister of Economics and Development, stops to talk with one of the many important industry representatives attending the opening.*



RESEARCH ... *THE KEY TO DUNLOP QUALITY*



RADIAL PLY— TIRE OF THE FUTURE

Research conducts continuous programmes undertaken to improve tire performance and safety. The development of the Dunlop SP radial ply tire is perhaps one of the most significant resulting accomplishments.

This new tire design, although widely used in Europe for some time, has been delayed in North America by the need for suspension design modifications, now being completed by leading auto manufacturers.

The introduction of radial ply, braced tread Dunlop SP tires, will bring many advantages to motorists. Significantly improved cornering and braking, a smoother quieter ride at speeds over 40 m.p.h. and up to double the tire tread life.

EPT RUBBER— NEW ROOFING MATERIAL

One of the major discoveries resulting from research at Dunlop's North American Centre is undoubtedly ethylene propylene terpolymer, commonly known as EPT. This new elastamer has expanded the possible uses for rubber far beyond anything contemplated previously.

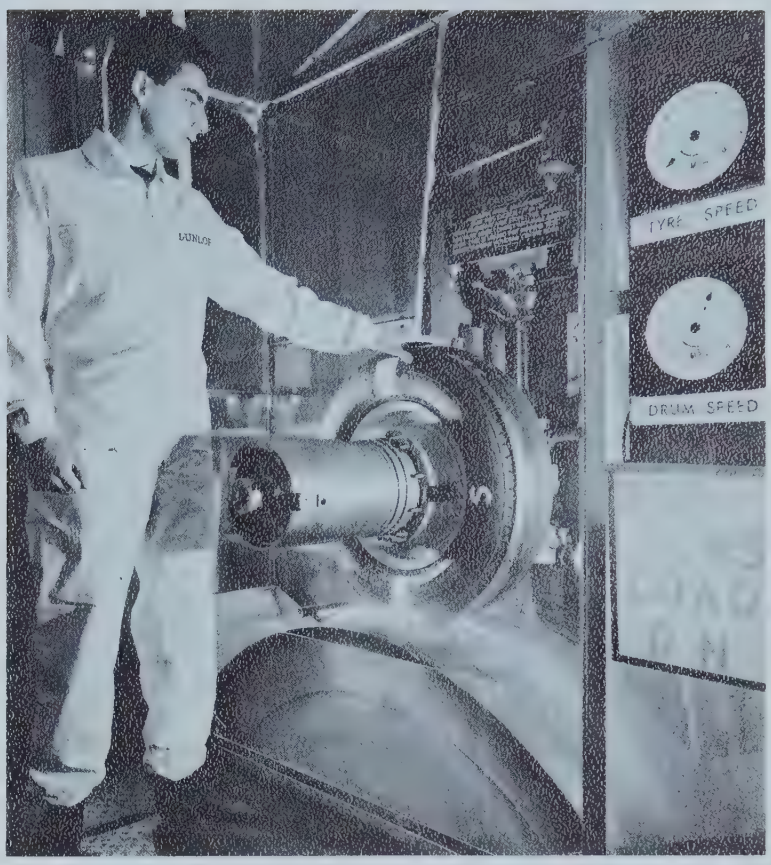
The remarkable features of the new rubber, such as its virtual immunity to weathering, ozone and sunlight, and its high resistance to damaging conditions have led to its quick adoption in a wide range of rubber products.

Flextop EPT, a flexible sheet rubber roofing material, is one of the newest uses for EPT, and because of its ease of application and immunity to climate is rapidly making conventional roofing materials obsolete. An added advantage of this new roofing system is its ability to accommodate the design complexities which are a feature of many modern buildings.

WATER-SKIING ON THE ROAD

Extensive studies of tire behaviour under extreme conditions pointed out to Dunlop researchers that many tires are simply unable to cope with wet road conditions. At highway speeds, water building up under the tires may actually lift the wheels off the road surface causing the vehicle to literally "ski" on a film of water.

This condition, termed "aquaplaning", is an extreme one, but it does happen and when it does it is beyond driver control and results are often serious. Now that the mechanics of this condition are known, counter measures are being taken to offset them. Improvements to the new Dunlop range of Gold Seal and Elite tires are the result of direct research into high speed wet-hold conditions, and mark a continuing study of the problems associated with the aquaplaning phenomenon.



BREAKTHROUGH IN HOT MATERIAL HANDLING

While rubber conveyor belting has always been extensively used for handling hot materials, there were, until recently, certain definite restrictions on temperature levels and, particularly when abrasion was combined with heat, service life was very low.

These heat limits have now been raised considerably and abrasion as a factor has been largely eliminated by the introduction of Dunlop Superhet Extra conveyor belting. Unlike conventional hot material belting, Superhet Extra which is based on EPT rubber, will not soften up under high temperature abrasive conditions, and evaluation of belts now in service has indicated an increased service life of at least 300%.

RESEARCH ... *THE KEY TO DUNLOP QUALITY*

FIRST CANADIAN LOW-PROFILE SNOW TIRE

At the specific request of automotive engineers, Dunlop has now designed and created a low profile snow tire to complement the standard low-profile tires generally introduced as standard equipment on 1965 cars.

These new Silent Traction tires were designed to minimize noise and provide improved lateral stability – particularly on station wagons. They are an exclusive development – the only low-profile snow tires made in Canada.

The testing of such tires, though strictly speaking not a research function, is done in close collaboration with Research who study the behaviour of polymer and textile under extreme conditions. Evaluation of the materials used and the finished tire was first carried out in the far north under incredibly rough sub-zero conditions. When their suitability for severe Canadian winters was established, testing was then carried out in the blazing hot sun and gritty biting sands of Texas, as a safety precaution for driving on dry pavement.

In this way, research theory and practical testing are combined to ensure quality and performance.

SAFETY SEAL FOR OIL HOSE

Designers in our product divisions, in collaboration with researchers, are continually striving to improve the serviceability of our many products. Polymers, textiles, constructions and manufacturing processes are all carefully examined. Although these studies can lead to broad findings which influence a wide range of products, more often they are directed towards the improvement of a particular item.

This was the case with recent work on Duncord and Peerless oil suction and discharge hoses. A potential problem with this heavy, large diameter hose – product loss due to failure at the couplings – had been largely overcome through the adoption of built-in steel nipples. This newer development, the inner "safety seal", goes one step further. In the event of any failure of the vulcanized rubber to metal bond, the seal, a ring of specially compounded rubber located between the hose and nipple, expands to prevent seepage. This is an added safeguard—another assurance of long, trouble-free service.

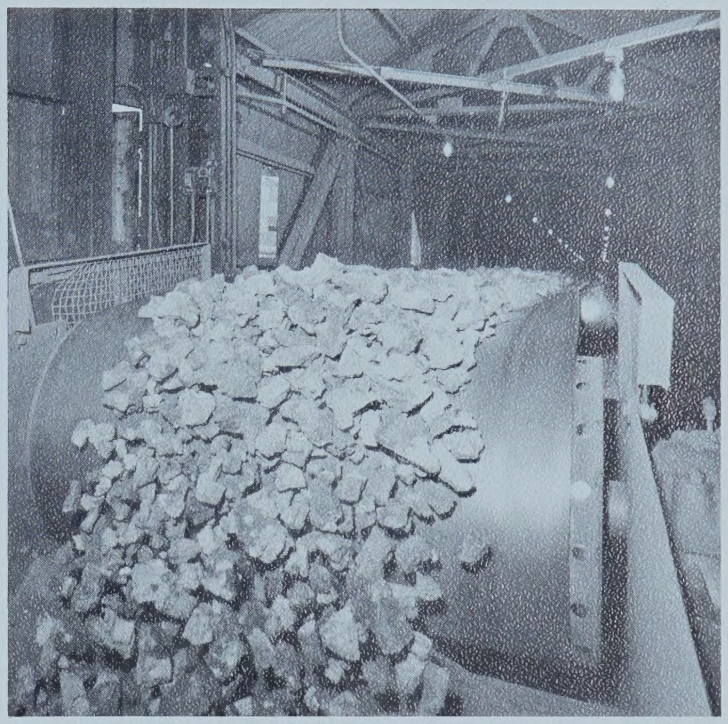
RESEARCH LEADS TO BETTER BELT DESIGN

Two areas of research, one into the development of better quality synthetic rubbers and one into the design of high strength lightweight textile reinforcements, have resulted in a quiet revolution in the design of conveyor belting for industry.

These improved rubbers and textiles, and a third programme revolving around improved systems of combining them, have resulted in the introduction during the past few years of two completely new ranges of Dunlop conveyor belting.

Dunstar belting, a rayon-nylon fabric reinforced belt, has within a short time become recognized as the ideal belt for industry's most demanding services, while Flexilon, a lightweight all-nylon fabric reinforced belt, has been widely specified for a multitude of light to medium duty installations.

Belt development is an unending programme and new designs with even higher service ratings are continually being evaluated in the light of steadily increasing service requirements.



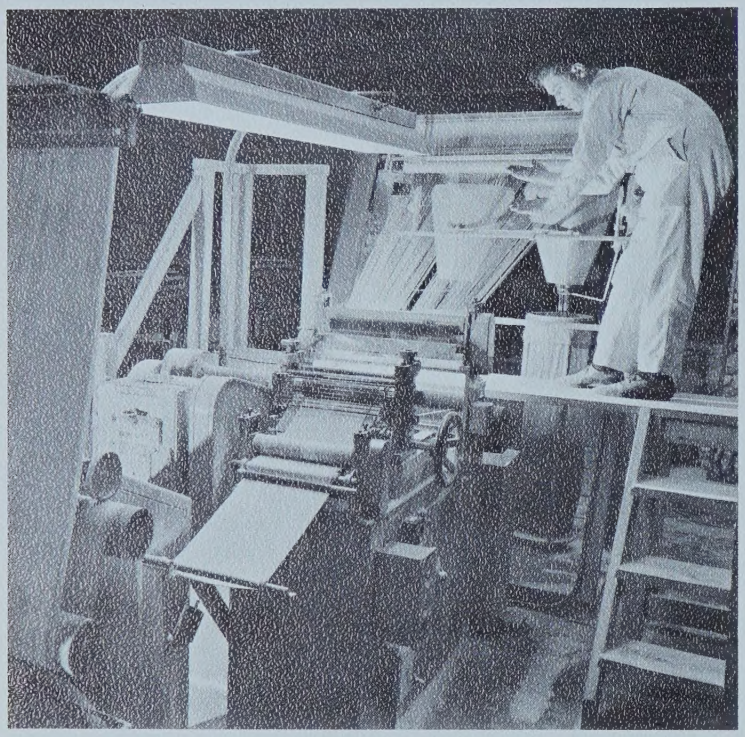
COLOUR BLENDING OF PLASTICS

The research activities of Dunlop, although basically centred on rubber, have always included other materials, and particularly plastics. This is evidenced by a long and growing list of products such as polypropylene tank linings, PVC belting and hose, urethane foams and moulded parts, and resinous adhesives, to name just a few.

Research evaluation is a basic part of the recently expanded Dunlop colour compounding plant at Ajax, Ontario. This plant was designed to assist manufacturers of plastics goods who had previously been faced with the problem of blending and colouring their own plastic materials before producing their final product.

Colour compounding at Dunlop's Ajax plant now enables them to have this exacting match handled by specialists outside their own factories. The Ajax operation, largest of its kind in Canada can, because of its size and specialized equipment, process bulk quantities and yet maintain complete colour consistency.

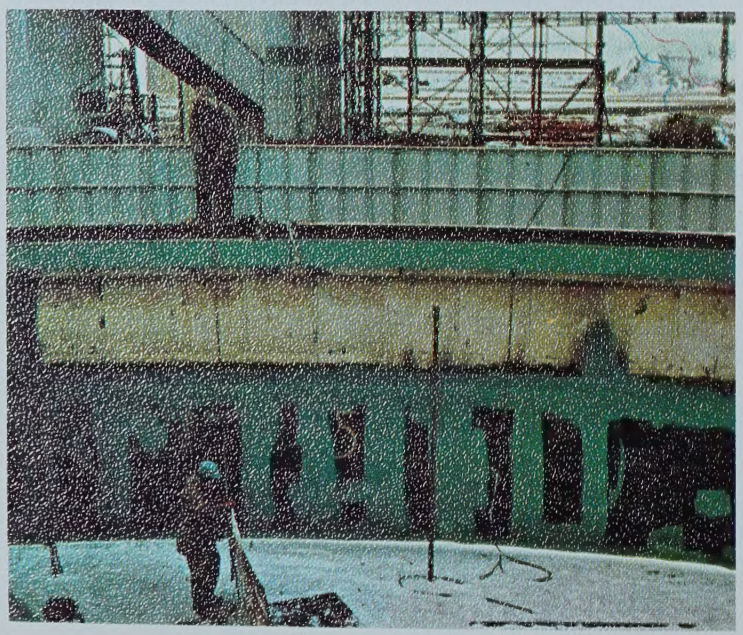
RESEARCH... *THE KEY TO DUNLOP QUALITY*



SCIENCE ON THE LINKS

Most of us, when we think of research, are inclined to visualize such efforts being directed towards the fields of industry — transportation, electronics, space and other such immense undertakings. While this is largely correct, life is not all so earnest and a lot of remarkably successful research goes into products for our growing leisure hours.

The search for improvements goes on just as strongly in this area as any other. This is demonstrated by recently anounced improvements to the Dunlop '65' Golf Ball — a product which was already tops in its field. More than two years of concentrated development has led to an improvement in every component of the ball, from a newly created latex thread which improves the flight distance of the ball to a tougher, whiter cover.



FIGHT AGAINST CORROSION

The widespread and increasing use of chemicals in industry has meant a corresponding increase in problems of corrosive attack. Annually, millions of dollars are spent on the upkeep and repair of buildings and equipment affected by the corrosive action of liquids and vapours.

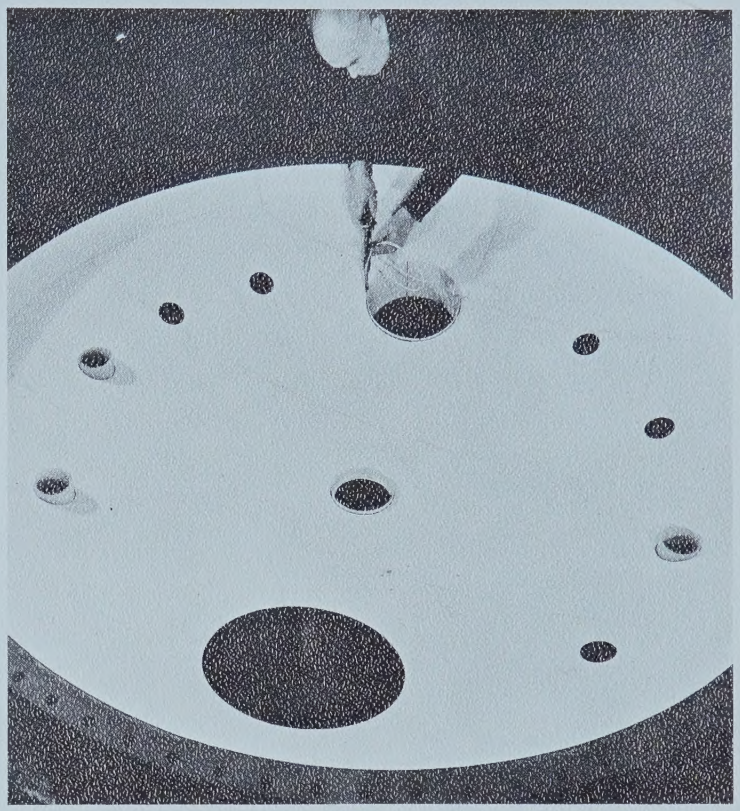
Rubber has long been in the forefront of the materials used to arrest corrosive attack. Dunlop research is engaged in a continual search for improved methods of protection against corrosion and research-developed rubbers are widely used in chemical processing industries all over the world.

Rubber protective systems are now available in a wide variety ranging from thick, hard rubber linings bonded to metal down to easily applied protective coatings. These latter products are liquids based on two polymers — neoprene and Hypalon. They can be applied much like paint and dry to a tough elastomeric film which seals the coated surface from corrosive elements.

NON-TOXIC LINING MATERIAL

Research is not always a matter of discovering new products. Often it is the equally difficult task of finding ways to more efficiently utilize existing ones. A case in point is polypropylene which till recently, although recognized as an ideal lining material, had been severely limited in application. This was caused by polypropylene's high co-efficient of thermal expansion which prohibited bonding to it metal where high temperatures were involved.

Dunlop researchers overcame this problem through the development of a special process which allows a rubber backing to be bonded to the polypropylene sheet. In the resulting laminate, the elasticity of the rubber allows the polypropylene to expand in minute waves without imposing undue strain on the adhesive bond. The laminate — known as Dunclad P. L. — is used for lining process equipment in the chemical, food, beverage and pharmaceutical industries, and presents a solid white, inert, non-toxic and non-contaminating surface.



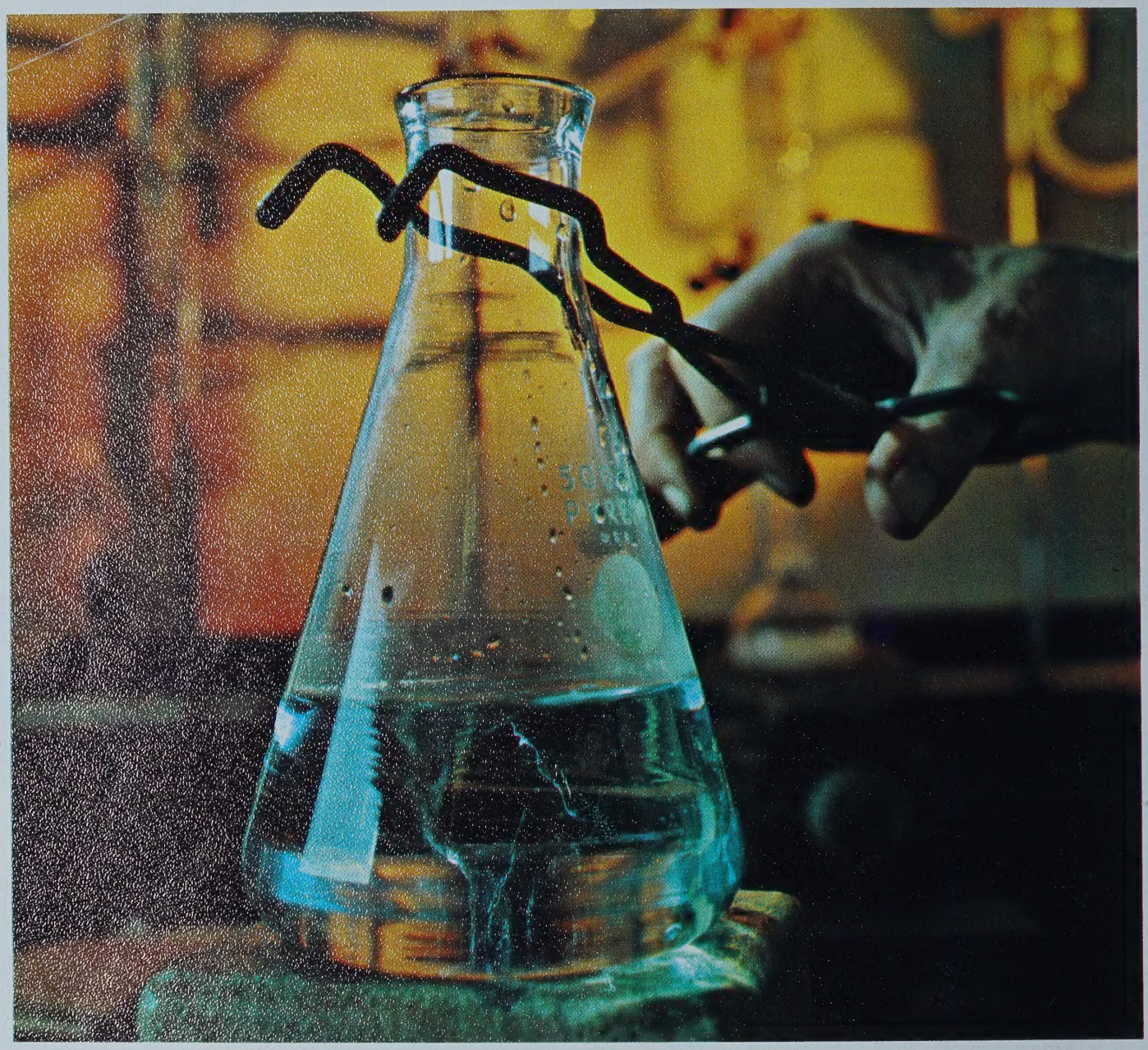
SOPHISTICATED ADHESIVE SYSTEMS

We have come a long way from 1600 B.C. when adhesives were first made by the Egyptians for use in embalming, to the highly sophisticated flexible adhesives which have been developed by Dunlop technicians. Probably the last three decades have seen more advances in adhesives design and technology than were made during the 3500 odd years since their use was first recorded.

Industry's increasing need for high strength, quickly-applied bonding systems for use as flexible, stress dispersion components, light-weight fastenings, etc., has stimulated the development of a whole new generation of adhesives and adhesive application systems. Such improvements have only been possible as the result of recent advances in chemistry and the development of new synthetic rubbers by pioneering researchers.

Today, virtually any material can be fastened to any other — permanently bonded with Dunlop Adhesives.

RESEARCH...
THE KEY TO DUNLOP QUALITY



A key, by definition, is used to unlock areas previously barred from scrutiny. Since the formation of Dunlop in 1889, research has consistently opened up new areas of quality improvement and wider aspects of product usage.

The important contributions Dunlop products have made to today's industry, home and everyday life are the result of yesterday's research. Today's research, of the kind undertaken at the Dunlop North American Research Centre, is the promise of a better tomorrow.

Research is truly the key to Dunlop quality—your assurance of complete dependability.

DUNLOP CANADA LIMITED